

The Mining Journal

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Behind the Bamboo Curtain

OF perhaps even greater consequence to the future of international relations than a settlement of the Berlin crisis or the success or failure of the United Nations to achieve a unified Congo, are the changes currently taking place in that most ancient of countries, China, which, as ever, remains an enigma to the West. Under its Communist rulers China is currently engaged in a rather breathless attempt to blend its traditional knowledge and centuries-old practices with Western and Russian concepts, the intention being to transform the country of Confucius and Lao Tse into one of the most modern, most highly industrialized and most scientifically advanced nations in the world. As in all long-term economic planning, realization of this aim depends first and foremost on the more effective utilization of the national resources of manpower and basic materials. China is accordingly endeavouring to accelerate the search for mineral resources and the expansion of mine and metal production.

While developments in the Chinese mining industry are of prime importance to the West, assessment of the progress achieved is hampered by such difficulties as the paucity of reliable information on production data, the modification of Western techniques and equipment to suit local needs, and the attention currently being accorded not only to the development of large and highly efficient mines and concentrators but also to the establishment of small-scale units of relatively low technical standards.

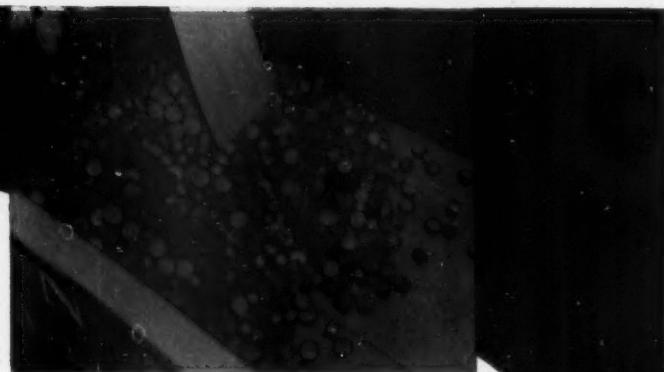
Western knowledge of the new China was summarized at a symposium held in December last year by the American Association for the Advancement of Science, the proceedings of which have now been published by the Association. Nearly thirty papers, each by a leading authority, were presented at this meeting. Among the contributors was Mr. K. P. Wang, U.S. Bureau of Mines, whose survey of mining and metallurgy is probably the most comprehensive and authoritative paper on this subject so far published in the West. A summary of parts of this paper appears on page 334.

Under the Communists coal production has been expanded to an annual level already six to seven times the pre-Communist peak. China is today the third ranking world producer of coal and its output is approaching that of the United States. Coal is of particular importance to China because her oil potential is still a question mark and her hydropower potential has not yet been utilized to an extent commensurate with resources. The coal reserves are both extensive and well distributed, which is particularly fortunate having regard to the seriously inadequate transport system. Chinese coals, which are mostly bituminous, are good by world standards, generally speaking, while most of the coal beds are thick, even, flat, and relatively close to the surface. The basic problem in China is not so much the finding of the coal, but the development, mining and utilization of the deposits. Wang considers that the coal industry of Communist China can no longer be considered

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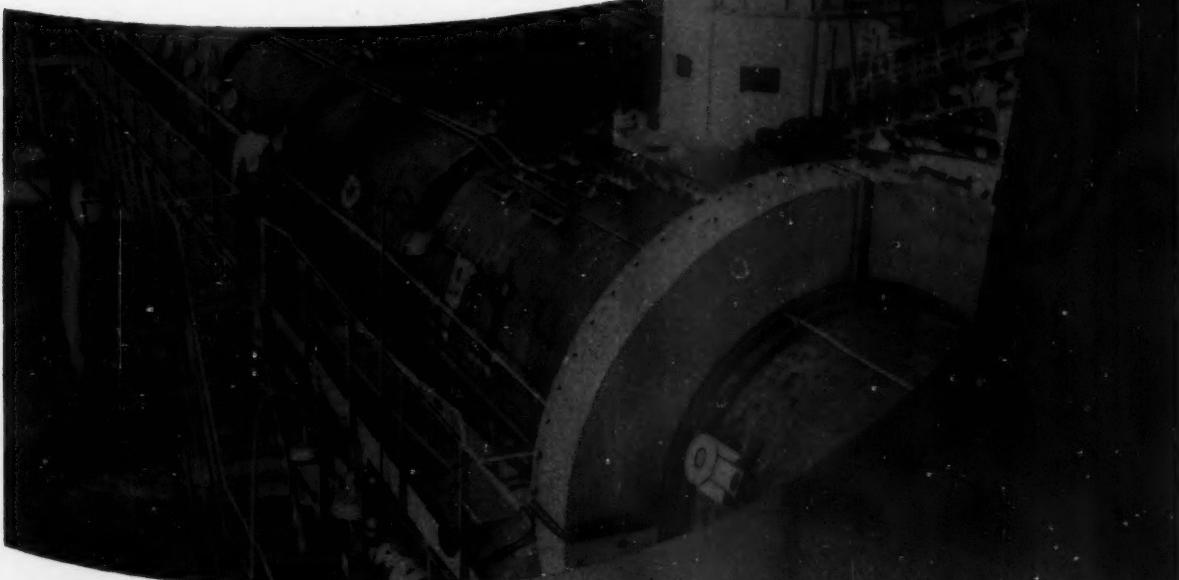


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backward by world standards; in fact, its general technological level compares favourably with that of the coal industries of most industrialized countries. Overall productivity in large mines has risen to 1.5-2.0 tonnes per man-shift, while the best record for a single mechanized working face is 15-20 tonnes.

Since 1950, about a thousand underground and opencut coal mines have been rehabilitated and constructed by the Bureau of Basic Construction, Ministry of Coal Industry; the new productive capacity so far created amounts to roughly 250,000,000 tonnes per annum. The agency has also built about 250 coal washing plants with a combined yearly capacity of approximately 100,000,000 tonnes of mine-run coal. Recently, the time needed for establishing underground mines has been roughly 20, 15 and 10 months, respectively, for large, medium and small projects.

According to Wang, the major basic construction projects that the Chinese are capable of designing and implementing include mine shafts of 2,400,000 t.p.a. capacity, modern coal washing plants of 4,000,000 tonnes, opencut oil shale mines of 30,000,000 tonnes, and integrated hydraulic coal operations.

The Chinese have not yet had a chance to do much research in coal beneficiation, but they have become proficient in adopting established world practices. Standardized plants of various sizes are being constructed at a rapid pace. Coal utilization has not only been greatly improved in iron and steel smelting but also in power generation and locomotive use. It now takes about $\frac{1}{2}$ kg. of standard bituminous coal to produce a kWh. of electricity.

Already the seventh largest world producer of iron and steel, China might well attain third place by 1970 or earlier. In the three years 1957-1960, the steel industry was expanded by about 10,000,000 tonnes to a capacity exceeding 15,000,000 tonnes. Future growth for the next decade will not be less than this rate.

Like coal, iron ore resources are found in large quantities in many parts of the country. There are many complex iron ores, ranging from those high in sulphur and high in copper to those high in phosphorus, fluorine, titanium or vanadium. China does not have anything like the Mesabi Range nor the iron mountains of India, so it has to learn more about technology to compensate for ore quality. A good start has been made through the utilization of better ores and integrated development of industries. Most raw materials, other than iron ore, needed in steel manufacture are more than adequate and technology is solving the problem of the few deficiencies. For instance, substitute metals are being used in place of nickel and chromium, which are scarce, in making alloy steels.

Iron ore is mined by many methods depending upon ore occurrence conditions, size of operations, and availability of equipment. Although many of the larger mines are considerably mechanized, about half the iron output is still won predominantly by hand methods. Most ore that is not suitable for direct smelting because of low iron content, high impurities and uneven quality, is now washed or otherwise beneficiated. A large portion of the ore is finally sintered before smelting. The iron ore or beneficiated iron product charged to the larger blast furnaces usually analyses 50-65 per cent Fe. The stress on quality is such that the upgraded product has often been obtained at an iron recovery of only 70 per cent.

In recent years China has been the leading world producer of tungsten and antimony and the second ranking producer of tin. These metals have been traditionally produced for export and Wang expects large surpluses over domestic needs to be maintained indefinitely, but domestic consumption is slowly rising.

Though China has had a commanding world position in

tungsten production since World War I, Chinese knowledge of tungsten technology was not particularly advanced, especially as regards the more highly processed tungsten products, until the Communists came to power. However, notable progress has been made in recent years, particularly in mechanization of mines and more efficient processing of complex as well as simple ores. The Chinese have also done considerable work on synthetic scheelite, tungstic acid, ferrotungsten and tungsten metal. Emphasis has been placed on the integrated recovery of by-products from predominantly wolfram or scheelite ores.

Tin has been extracted by primitive methods in China for thousands of years, but only in the last few decades has large-scale production been undertaken. Tin technology and production have made great progress since the Communists came into power. Mines have become more mechanized, many new mills have been built, smelting facilities have been expanded and improved. In recent years China has been producing tin at about half the rate of Malaya. All the tin is made into metal, the bulk being 99 per cent grade or better, with more than half 99.6-99.98 per cent grade. Domestic tin consumption is rising, but a great increase will only come about when the tin-plating sector of the steel industry becomes significant; by that time, states Wang, tin output probably can also be raised so as to maintain a large tonnage for export.

Recent output of mercury, bismuth and molybdenum ranks China fifth among world producers in each case. The Chinese have been familiar with mercury metallurgy through vermillion extraction for many centuries. They have recently acquired knowledge about established world practices and are particularly adept in small-scale operations. They have a great advantage in low-cost labour and the efficiency of mercury recovery varies considerably according to district. Chinese bismuth occurs with tungsten and non-ferrous metals, and improved ore dressing techniques have greatly raised recovery rates. Most bismuth is exported as concentrates. Molybdenum became relatively prominent recently as a result of new ore discoveries.

The need for non-ferrous base and light metals, in which—except for aluminium ores—China has traditionally been deficient, has become more urgent as industrialization proceeds. Production of copper, lead, zinc and aluminium has been greatly increased in recent years. Prospects are that China will become a medium world producer of these metals within five years, in spite of which deficiency may persist. The shortage of copper is the most severe; while the Chinese talk about substituting aluminium for copper, they also import aluminium. Various steps have been taken to increase the domestic supply of non-ferrous metals. Resource investigations have uncovered a number of important deposits, while much work has been done in rehabilitating old mines and plants and building new ones.

China's mining industry is thousands of years old and her knowledge of ore dressing and metallurgy goes back for centuries. The new wine of Western technology is thus being poured into very old bottles; the results could be unexpected—they will certainly be interesting.

MINERAL DEPOSITS OF THE CAIRNS HINTERLAND

The Cairns Hinterland, Queensland, is the subject of a recent statement by Senator W. H. Spooner, Australia's Minister for National Development. This area has been the scene of much mining activity since about 1880. Tin and gold are the principal metallic products and copper, lead, silver,

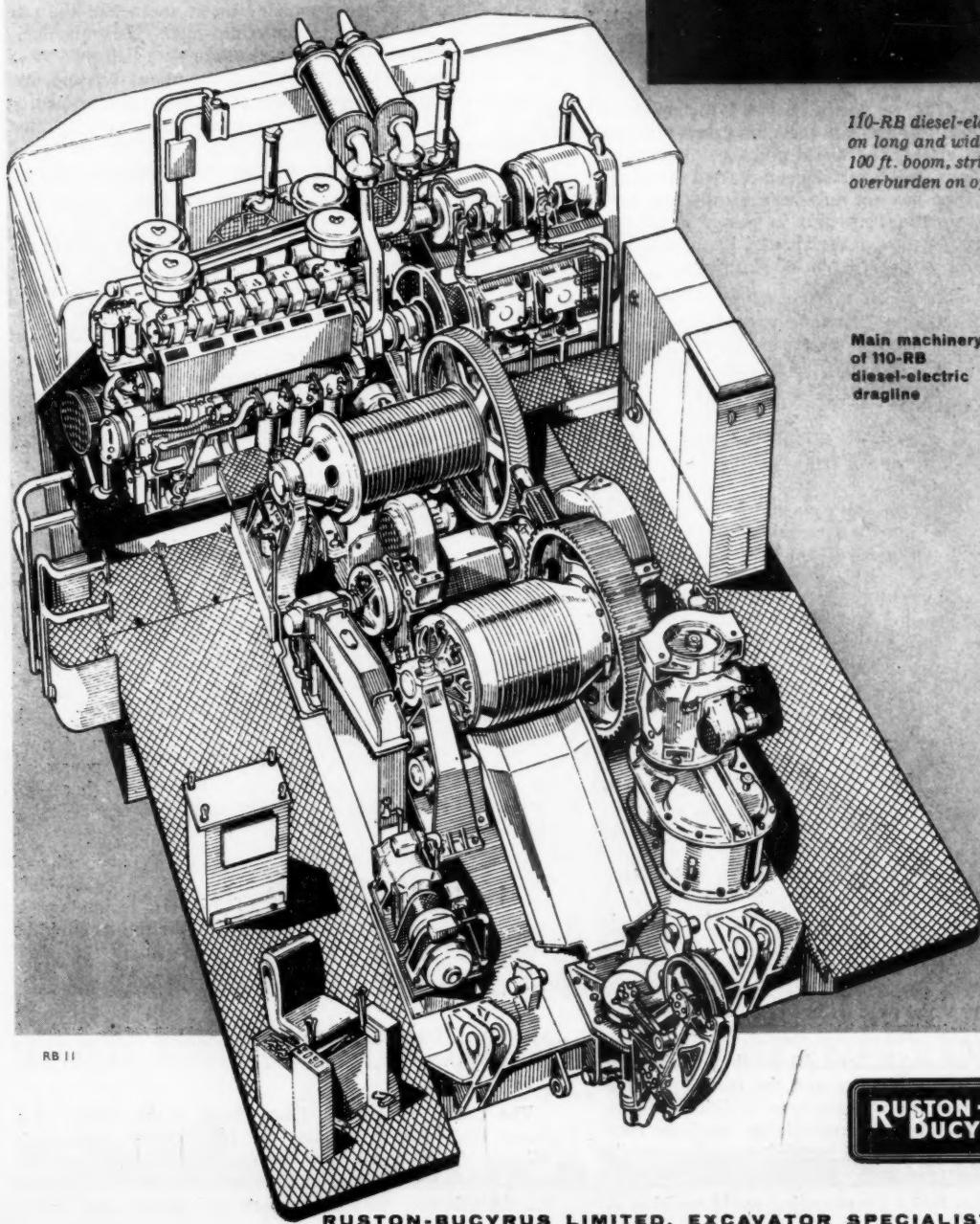
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tungsten, iron, fluorspar, molybdenite, antimony, and limestone have also been produced there.

The area still ranks as the major domestic source of tin in Australia with a production of over 1,000 tons of tin metal per year. Production from this region in the period 1880-1960 includes the following outputs: gold 2,881,000 oz., tin 120,000 tons, copper 53,000 tons, lead 31,500 tons, silver 10,000,000 oz., tungsten 11,000 tons, iron 50,000 tons, limestone 200,000 tons, fluorspar 31,000 tons, molybdenite 3,000 tons, and antimony 2,500 tons.

Geologists from the Bureau of Mineral Resources and the Geological Survey of Queensland have been co-operating in a regional survey of some 56,000 square miles of this area, including all the known mineral provinces, and extending to Ewan in the south, Cooktown and Cape Melville in the north, and Croydon in the west. This survey commenced in 1956. It is still in progress and will be continued for some time.

The survey is designed to provide basic scientific information which is being used in an attempt to develop new approaches to mineral discovery and to provide a basis for more detailed investigations of the mineral potential of this very large area.

A secondary, but nevertheless important aim is to stimulate other investigations by mining companies in the region by publishing the information gained from the regional survey.

Tin is currently one of Australia's major mineral imports and as the country's known resources (and indeed the world's) are limited and consumption is rising, the import bill for this metal is likely to increase in the future. The geologists engaged in this survey are therefore concentrating their efforts in an attempt to discover new tin deposits and hence increase the life of these important fields. One new prospect already found in the course of this study is due to be tested.

Mt. Isa Mines Ltd. and Consolidated Zinc Ltd. have been active in the Cairns area in past years conducting a survey for new copper deposits, New Consolidated Goldfields Pty. spent two years in searching for tin and other metals, and Broken Hill Pty. Ltd. is currently engaged testing old mines in the Herberton area.

COST OF THE CHILE STRIKES

In our issue of September 15 (p. 251), we published a few figures regarding the cost of the recent copper strikes in Chile, which lasted from August 10 to September 11. More detailed and up-to-date figures have since been issued, according to which the loss of production amounted to some 41,000 tonnes of copper, the loss of dollar exchange in currency returns to the country to \$15,624,000 and the loss of income tax to the Chilean government from the struck companies to \$7,006,000. The loss in sales of materials, supplies and services to the struck companies for operating purposes came to \$2,500,000, while the workers lost wages and salaries amounting to \$4,225,000.

According to the government-owned newspaper, *La Nacion* of Santiago (as quoted by *American Metal Market*), to these items must be added: loss to the national treasury of returns from new taxes assessed against the large copper companies such as one to finance rises in pay for the army; loss of wages by stevedores and other port workers due to a halt in imports of equipment and supplies by the copper companies; and cessation of copper exports during the strike.

Moreover, as *La Nacion* points out, consumers of Chilean copper who, because of the strikes, do not get deliveries in time, must supply themselves from other sources such as Rhodesia, Katanga or Canada. It is probable that as a result of each strike important customers who have been forced to change suppliers are permanently lost. Strikes played an important part in the decline of

Chile's nitrate industry, recalls the journal, because they prevented successful confrontation of the initial competition from synthetic nitrates. They could be equally harmful to the copper industry. Unfortunately the outlook for peace in the Chile copper industry is by no means encouraging. Though nearly half the strike truce period of 60 days has now expired, no settlement is as yet in sight. Moreover, workers at Chuquicamata, whose contract expires on December 31 this year, are demanding a 40 per cent general wage rise, plus fringe benefits; an increase of this order is hardly likely to be acceptable to Anaconda and the gap may not be easily bridged. A dependable output of copper is of key importance in Chile's 10-year plan for economic development covering 1961-1970, the success of which would be a heavy blow to communism. Politically, however, the leaders of the Copper Workers' Federation are for the most part associated with the Popular Alliance Front, a coalition dominated by Communists and Socialists of the extreme Left, in whose eyes the promotion of frequent strikes in the copper industry is a useful weapon to embarrass the present government.

A tripartite commission to deal with a copper workers' labour statute has been officially established in Santiago. It consists of three representatives from the unions, three from the copper companies, and three from the government. The commission is to report within 60 days on a new "national contract" for copper workers lasting 12 months instead of the present individual labour contracts between the companies and their unions which last for 15 months. On the face of it, a new set-up on the lines envisaged could make a valuable contribution to industrial peace, provided the negotiating machinery was such that no contract could be imposed on the industry without the agreement of the companies. In the absence of adequate safeguards Anaconda and Kennecott could scarcely be expected to relinquish the right to negotiate their own agreements with their own workers, however advantageous the commission's proposals might appear in other respects.

BRITISH COAL IN THE COMMON MARKET

A recent news bulletin from the German Federal Republic may in some measure allay the fears of those British Trades Unionists who view askance the possible entrance of the U.K. into the Common Market.

A study group of the German coal industry has begun to examine the possible consequences of British entry into the Coal and Steel Community. The studies, so far, have indicated that the centre of gravity of the Community would move to the U.K. in the case of British entry. The British coal industry produces approximately as much coal a year as the six member nations of the Community together, while in addition the costs situation in the British industry is, in some respects, more favourable than on the Continent.

The study group has said that the costs of social services are borne to a greater extent on the Continent than in the U.K. by employers and employees in the coal industry. In Great Britain these costs have been calculated at about DM.3 per ton of coal, compared with DM.7 in the Community. The British industry benefits also from cheaper freight costs.

The group concludes that competition between Britain and the Six in coal sales will take place on the Continent rather than in these islands. However, the group expresses little concern at this prospect in view of the large requirements of British industry for indigenous coal and what it considers to be the limited possibilities of rationalisation in the British industry, together with the poor quality of British coking coal.

COMMUNIST China has made rapid technological progress in mining and metallurgy during the last decade. The general technological level of the larger mineral enterprises is slightly behind that of the traditional industrial countries, but in some specific fields of endeavour it compares favourably with the best in Western practice. Mechanization lags behind basic engineering, however, because of inability to build equipment quickly enough and the availability of cheap manpower. This explains why small mines and plants of relatively low technical standards have been established alongside large and efficient ones.

When the Chinese Communists assumed power in 1949, they took over a mineral industry consisting of badly damaged and overworked facilities in Manchuria, a group of Western- and Japanese-developed mines and plants in north and central China, and various small Chinese enterprises scattered around China proper. The problem of the first three years was primarily one of rehabilitation, reconstruction and learning industrial practices. Subsequently, the First Five-Year Plan (1953-57) was launched with vital assistance from the Soviet Union. This was a period of improving existing operations, building new mines and plants, applying proved world techniques, originating new methods suitable for Chinese conditions, and research and setting up institutions capable of training the necessary technical manpower.

Then came the "Leap Forward" year of 1958, signalling the beginning of the Second Five-Year Plan. Among the by-products of the "Leap Forward" were the accumulation of much information on mineral resources and the training of a large number of persons in the fundamentals of mineral extraction. Consolidation and streamlining of mineral enterprises took place in 1959, followed by another year of steady progress. Towards the end of 1960, most of the original mineral-output goals for the Second Five-Year Plan had already been attained and the technical status of the mineral industry had advanced to a level at which it was capable of contributing a little original thinking to mineral technology.

Many design, research and educational institutions have been established and/or expanded to support the development of the mineral industry. On the national level alone, there are probably about 50 such groups. Institutes such as the Tangshan Coal Mine Design Institute, the Peking Coal Preparation Institute, the Ferrous Metals Design Institute and the Non-Ferrous Metals Design Institute have played an important role in designing and constructing Chinese mines and plants. These design institutes have been ably assisted in mineral research by the Academia Sinica and in training of staff by the educational institutions. In addition, many local organizations give technical and manpower support to mineral development.

Mining Technology

Small-scale mining has been carried on in China for thousands of years, and the methods employed had hardly changed until around the turn of the last century. When Western concepts of mining were introduced, initially in the coal mines, the emphasis was on systematic operations and application of equipment related to basic services rather than extraction at the working face. Some of these concepts have since been applied in varying degrees in small-scale operations, but generally only to the extent that manpower and animal power are still applicable, as for example in some hoisting and conveying arrangements. On the other hand, notable progress in mechanization has taken place in medium and large-scale mines, which provide about two-thirds of the national mineral output. It is

Mining in

mainly to this group of mines that the observations which follow apply.

Mechanical equipment is essentially powered by electricity, steam and compressed air, which are derived from coal rather than oil, because coal is plentiful and oil deficient. Haulage is primarily on rails, by electric and battery "motors" underground and by steam locomotives on the surface; ventilation, hoisting and pumping, by electrical equipment; and drilling and loading, by compressed air and electrical equipment. Wood is sometimes substituted for steel in, for example, mine car bodies and rails because of a shortage of iron and steel. The supply of mine timber is also inadequate, a fact which has led the Chinese to implement various timber-saving and substitution measures. Underground mines are more important than are opencut mines. In recent years, the Chinese have developed the capability to manufacture most of the basic mining equipment needed. However, not enough equipment is produced, so that what is available must be utilized to the maximum degree. The Chinese claim that the "four eight-hour shift overlapping system" recently introduced has had an important effect on making the best use of equipment and in raising overall mineral production, by eliminating equipment down time during shift changes.

In preparation for mine development, a fair amount of exploratory drilling is done. The thoroughness of this preliminary work varies but, in general, it would be considered sub-par by Western standards. However, not many cases are known where reserves subsequently prove inadequate to support the designed scale of operations.

Many special design and construction units have been organized to handle mine development. In some cases original design is essential, but, more commonly, a standard design is either adopted outright or modified to fit a specific deposit. The concept of standard designs has proved particularly effective in coal-mine development. The time needed to bring a large mine into production generally has been less than 2 years and a medium mine less than 1½ years. As of early 1960 the Chinese claimed the following approximate monthly records for mine development work in metal mines: vertical shaft and inclined shaft 120 m.; horizontal tunnels 430 m.; and stripping of overburden with a 3 cu. m. shovel 650,000 cu. m. While the average rates are much less than half these figures, there is strong evidence that this phase of mining operations is done very well.

The Chinese have become proficient in shaft construction, both under regular circumstances and in soft ground and excessive water situations. Even special methods like freezing, drop-shaft and sheet piling are employed in shaft sinking. Conventional practices have also been adopted in tunnelling, except that the equipment used is generally of Soviet design. Multicycle operations in each shift, simultaneous use of several drills in each working place, and millisecond blasting are done to an increasing extent in both shaft sinking and tunnelling. Roof bolting, spraying of cement, and prefabricated linings are commonly employed. The haulage systems around the shafts and to the working places are systematically developed.

The basic mining methods employed by the larger mines in China do not differ appreciably from practices elsewhere in the world, but there are certain variations related to Chinese conditions, the historic influence of Japanese exploitation, and the recent impact of Soviet technical assis-

begin China

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A survey of mining and metallurgy in China was presented by K. P. Wang, U.S. Bureau of Mines, Washington, D.C., at a symposium held by the American Association for the Advancement of Science at its New York meeting on December 26-27, 1960. Parts of Mr. Wang's extremely comprehensive review are here summarized. The proceedings of the symposium have been published by the American Association for the Advancement of Science, Washington, D.C., as a volume of 872 pages, edited by Sidney H. Gould and entitled "Sciences in Communist China". The publishers' agents in Britain are Bailey Bros. and Swinfen Ltd., Hyde House, West Central St., London, W.C.1. The U.K. price is 140s.

tance. A few broad generalizations can be made. Chinese coal mines, as well as some other non-metallic mines, usually have thick beds that are amenable to highly mechanized methods of extraction. However, the degree of mechanization, particularly at the working face, is much below U.S. standards. Secondly, the principal opencut iron mines are now relatively well equipped, except that power is by thermal electricity, haulage and equipment mounting are by rail, shovels and draglines are not large, and bulldozers and self-loading diesel wagons are not used to any great extent. Thirdly, for most non-ferrous mines and some non-metallic mines, ore reserves are not so extensive and extraction methods are similar to Japanese practice. Fourthly, there are many medium-sized mines that, although well designed, do not have much equipment and therefore must rely primarily on hand methods for ore extraction.

In coal mining, the main method employed is the long-wall retreating system and variations thereof. The most advanced types of equipment used are combines and cutters, coupled with conveyors and retrievable steel props. The Soviet influence in coal mining methods and equipment is very apparent, but the Chinese have made changes such as increasing the cutting height and depth of the combine and designing very high lift pumps for hydraulic operations.

Hydraulic mining has been done in stripping overburden and in alluvial ore extraction; it has even been tested for breaking medium hard rock. Many conventional underground mining methods are employed for massive type and vein type orebodies. Rapid multicycle operations are stressed to cut down timber support, ore dilution, and clogging of draw points.

The Chinese have done well in mechanizing basic services in mining to the extent feasible. In ventilation, investigations have been made in calculating oxygen consumption, air volume and air loss indices. Various types of high-lift and underwater pumps have been built. There is a concerted effort to introduce ball bearings, mine cars, automatic turn plates, self-dump slips, conveyors and aerial tramway systems. Efficient native-style hoisting equipment is being built, and the Koepe system of multicable friction drive hoisting has been studied for future application. Automatic controls are being introduced to hoists, pumps,

fans and other equipment. Much work has been done in the field of explosives and blasting. There are several bureaux to promote mine safety. For the past few years, the Chinese have been studying rock mechanics in connection with mining methods.

Ore Dressing

Most minerals exploited in the pre-Communist period were of the direct shipping grade or easy-to-upgrade types, primarily designed for the foreign market. Thus there was no great incentive to apply modern ore-dressing techniques.

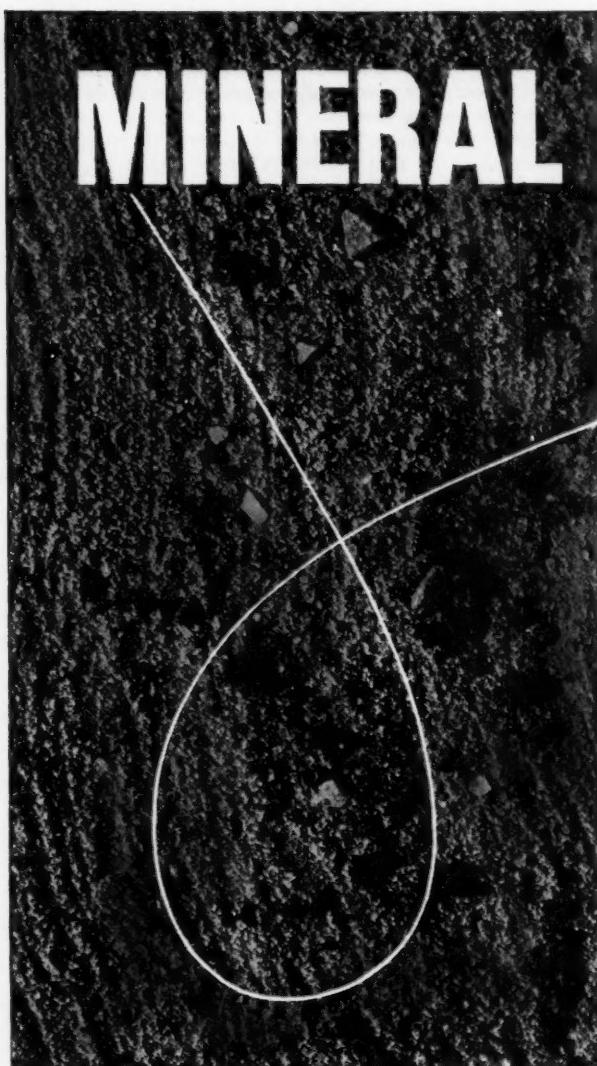
Domestic and foreign requirements for quality mineral products have risen markedly in the last decade, particularly since the "Leap Forward" year of 1958. As a result, the Chinese have had to build more and better ore beneficiation facilities. Foreign equipment and technical assistance were vital in the First Five-Year Plan period. Thereafter the Chinese started to learn more about modern techniques and design and began to produce basic milling equipment and flotation reagents.

Simultaneous with the installation of new facilities, there has been great emphasis recently on better utilization of existing facilities in terms of raising handling capacity, improving mill recovery, and producing better grade concentrates. The Chinese have used this approach not only for increasing production and extracting more useful values from the ores, but also for cutting down on unit transport costs and reducing smelting load. Apparently good results have been achieved, at least for the larger plants, and milling practices are approaching European and Japanese standards. Recovery rates have been reported as follows: sulphide copper 94-98 per cent; galena 92 per cent; sphalerite 87 per cent; low grade siliceous iron ore 70-90 per cent; wolframite 80-90 per cent; placer tin 85 per cent; and lode tin 65 per cent. The concentrates produced are generally high grade and many by-products are recovered.

As an indication of the advanced techniques now being adopted, it is stated that a combination flowsheet consisting of gravity concentration and hydrometallurgical treatment (high-pressure digestion and leaching) has been successfully adopted in the treatment of scheelite middlings. The Humphrey spiral classifier has been applied in many types of operations. The Chinese consider this piece of equipment to be not only very useful but also cheap and easy to make. Heavy-media separation is being increasingly applied. It is also noteworthy that many types of flotation reagents of high collecting strength and low manufacturing cost are said to have been developed from indigenous raw materials.

Metallurgy

Metallurgy has had a long history in China, but it was not until the end of the nineteenth century that modern large-scale practices began to be adopted. Progress during the next half century was of little consequence, save for the Japanese-controlled iron and steel plants in Manchuria and the antimony smelting industry in Hunan Province, South China. The situation has changed radically during the last few years. The Chinese have become proficient in iron and steel metallurgy and have learned, and in some cases improved upon, conventional non-ferrous smelting practices. Although they have not yet attained the general technological level of Western and Japanese practice in metallurgy, progress has been rapid and, judging from expansion programmes under way and research being done in this field, it appears that less than a decade will be needed for China to catch up.

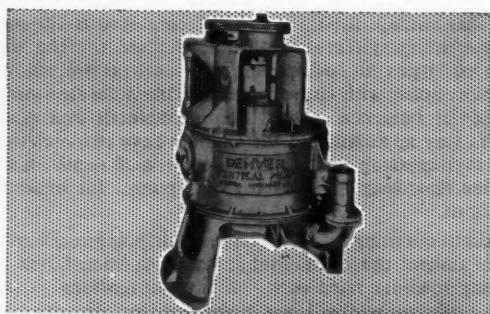


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Electronic Sorting of Mine Ores

IT has long been known that the gold-bearing ores of the Witwatersrand contained radio-active material. In the course of the development of the uranium industry Geiger counters and scintillometers were used in reef-picking and checking waste-sorting on mines where uranium was the main product and, latterly, to a certain extent on by-product properties.

It was found that the gold-uranium relationship on most mines was relatively constant. In view of this, the possibility existed of making use of this phenomenon as the basis of some sorting device.

Wright, Anderson (S.A.) and its associate companies—Selby Engineers and W. A. Electronic Equipment—have obtained the sole licence for the manufacture of this equipment for Africa. A pilot plant is under test at Hartebeestfontein, and it is reported that installation at Loraine is planned.

Operation of the Equipment

In operation, the run of mine ore is screened and washed. The fine material goes directly to the mill, but the coarse material is sized if necessary and fed into one or more sorting units depending on the throughput. In each case the washed and sized ore feeds into a small hopper, thence by means of a vibrating feeder onto a conical inline feeder. The inline feeder spins at high speed and throws the pieces of rock against a side skirt plate, thus forming the stream of rocks into a single line. As the pieces of rock move round they fall one at a time onto a short conveyor belt.

They are carried on the conveyor belt and fall over the end in succession. The detecting and sorting which then takes place occurs while the pieces of rock are in free flight; they are not touched mechanically during this process, thus wear and tear on plant is of a very low order.

As a fragment of rock falls over the end of the conveyor it passes between a neon light and a photo-electric cell which together act as a transit timer. The neon tube operates on alternating current at 5,000 cycles per second and the photo-electric cell is so tuned that it is only sensitive to light impulses of this frequency. There is no possibility, therefore, of light from any other source affecting this cell in any way. The purpose of this device is to measure the time of transit of the piece of rock and thus determine its size.

Continuing in its fall the piece of rock passes in front of a scintillometer which determines whether its radio-activity is above or below a pre-set level. This determination is the basis for classifying each piece of rock as pay or unpay. As it falls still further it passes in front of a series of air jets controlled electronically by the transit timer and the scintillometer. If the scintillometer has determined that the piece is payable, the air jets do not operate and it falls into a pay bin. If the scintillometer, however, determines that the piece is unpayable a blast of air—the duration of which is controlled by the transit timer—blows the piece over a dividing plate and into an unpay bin. From these two bins conveyors take the material to the mill or to the waste dump.

The speed of the electronic operating devices is such that a continuous fast moving line of rocks can be dealt with, each individual rock being measured, examined for radio-activity and sorted into the pay or unpay bins. Thus a high

throughput with a closely-controlled cut-off is attained.

A further advantage of the system is that it will reject non-radio-active substances such as wood, pieces of steel and other material which could interfere with the further processing of the ore.

The unit has been demonstrated in Benoni, Transvaal, adjusted to handle rock of a size of over 2 in. and under 8 in. Its capacity varies from between 25 to 50 tons per hour, depending on the primary crushing size.

One operator can supervise six radiometric sorting units and power requirements are 4 h.p. Compressed air requirements are 50 c.f.m. per unit at 80/90 p.s.i. (250 to 300 c.f.m. of free air).

Floor space required per unit is 8 ft. by 12 ft. The units are usually worked in pairs. Vertical height required for two or four units is 20 ft. including 2½-ton feed bins and discharge chutes. Approximate weight is 7 tons.

The total distance from when the rock interrupts the neon light beam till it passes the blast jet is approximately 2 ft. 6 in. and any measure of time, say, for a 2 in. rock is less than 0.1 of a second. To avoid background count the scintillometer is encased in approximately six tons of lead giving a shield thickness of 6 in. to 7 in. In the patented mechanical blast valve used, 50,000,000 operations are made before replacement need be considered. It is capable of operating up to 130 times per second.

Use of the Method

The obvious use of electronic sorting is to replace existing plants ahead of the mill. The advantages in this case include: the elimination of sorting labour; probable increase in the quantity and a decrease in the value of unpay material rejected; and accurate control of the cut-off value for the most economic running of a mine. Where electronic sorting would seem to have its major applications is far earlier on in the production process—immediately following stoping. There is a growing tendency in the gold mining industry to change over to longwall and long-hole stoping methods. From this aspect, waste sorting as near the face as possible is desirable, so that the maximum amount of ore is despatched on its way to the mill.

In addition, both methods call for extensive waste-packing for roof support. Accurately sorting on the spot, therefore, provides the necessary material and sharply reduces the risk of payable ore being built into packs—a present major problem on properties where gold is found in high-value narrow reefs.

Depending upon its economics, it might well be possible to install a battery of electronic sorters at a strategic point between stopes and main haulages at which a calculated amount of waste could be sorted and returned for packing. Effective exploitation of this could have an appreciable effect on costs—working and capital.

The electronic sorter was primarily evolved for use in uranium mines. Splitting of run of mine ore into high- and low-grade uranium content is practised on Doornfontein and West Driefontein using the physical characteristics of the Carbon Leader in a screening system. The equipment has been described in *South African Mining and Engineering Journal*.



Three P&H Electrics are working at Craigmont's open pit mine on the side of Promontory Hill at an elevation of 4200 feet. To date, the three 4½-yd. P&H Electrics have loaded out over 250,000 tons of ore for stockpiling at the mill plus well over 450,000 tons of waste rock.

AT NEW COPPER MINE IN BRITISH COLUMBIA...

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CRAIGMONT MINES LTD., uses three 4½-yd. P&H Electric Mining Shovels to move 1,700,000 tons of overburden and ore during first 2½ months on the job.

The new mine, 9 miles west of Merritt, is the first major base metal ore deposit found in British Columbia in 40 years. To work it, Craigmont Mines purchased three P&H Electrics. They are very pleased with the production obtained to date. It has exceeded estimates by an average of 25%.

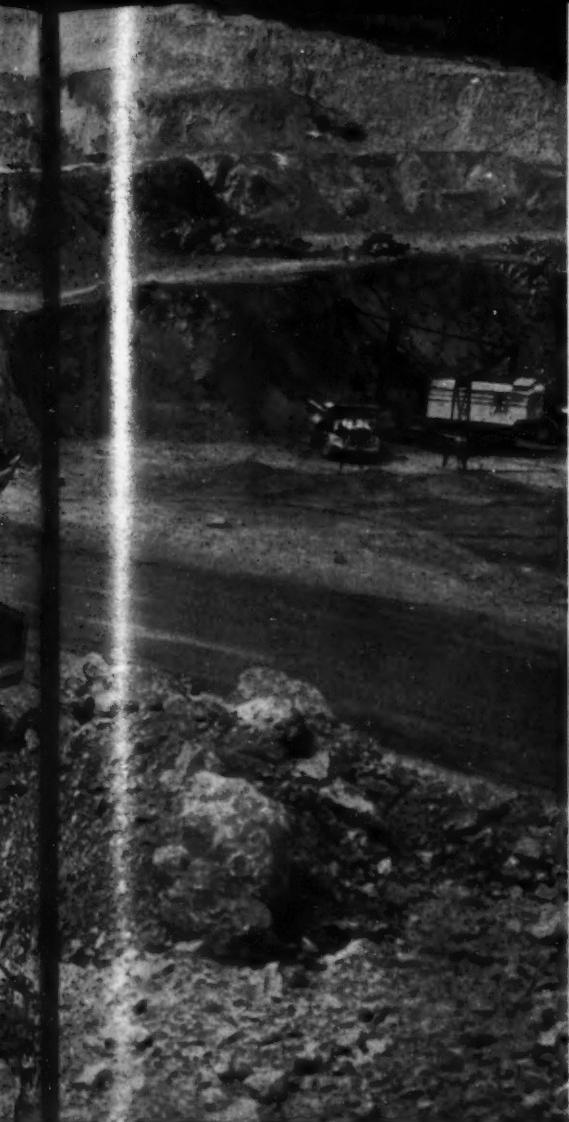
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Magnetorque Hoist Drive combines with P&H Static Electronic Control to provide fast cycling speed. Each of the 3 P&H Electrics is loading out an average of 7,000 tons per eight-hour shift. The opera-

tors say that P&H Static Electronic Control, with its ease of operation, lets them put in a full 8 hours without tiring toward end of the shift.

Magnetorque Makes the Big Difference

On the job, the P&H Electrics get full dippers every pass. It's due primarily to exclusive Magnetorque. This A.C. motor/direct-driven, eddy-current coupling provides higher/bail pull... delivers the P&H Electrics' exceptional digging power at uniformly high speed during the dippers' entire pass through the bank. And it does so without need for dipper manip-



P&H Magnetorque Hoist Drive automatically provides higher ball pull, extra power to meet increasing resistance in the bank and maintains uniformly high dipper speed while digging.

P&H Static Electronic Control responds instantly . . . provides fast, precise spotting and highest productivity.



exceed output expectations by 25%

ulation to avoid stalling. Result—faster digging and better fill factor.

P&H Electrics Highly Recommended

In addition to price and delivery, prime factors in the selection of these P&H Mining Shovels to supply this 4,000 ton-per-day mill included: favorable recommendations from other owners about the performance of their P&H shovels, as well as favorable comments about the speed and reliability of P&H parts and service.

Before you buy an electric mining shovel—make sure you've compared all performance factors. For more information on the Craigmont operation, write for Case History Report No. 150 to Harnischfeger Corporation, 4400 West National Avenue, Milwaukee 46, Wisconsin, U.S.A.

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BTR PRODUCTS FOR THE MINING INDUSTRY



CONVEYOR BELTING

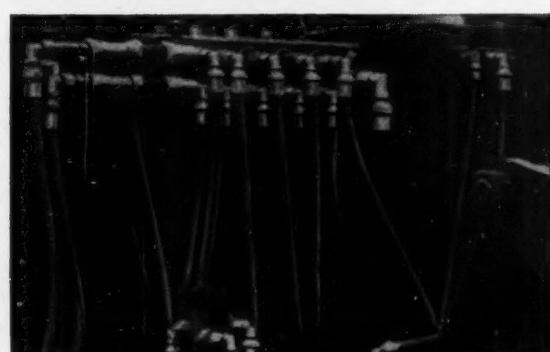
BTR specialise in designing and manufacturing conveyor belting for all applications . . . belting of advanced construction incorporating ducks of cotton and/or man-made fibres such as Terylene, nylon and rayon . . . belting with covers of natural or synthetic rubber or PVC—all of enduring quality. The BTR Group is the largest supplier of PVC Fire-resistant Anti-static Conveyor Belting to the National Coal Board of Great Britain.

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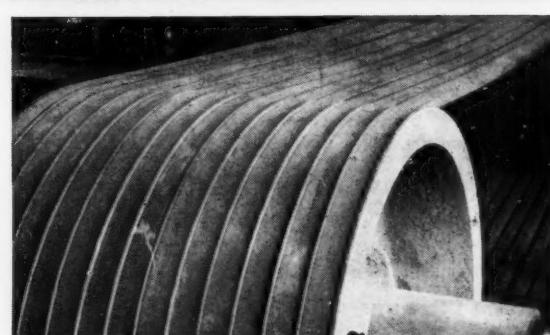
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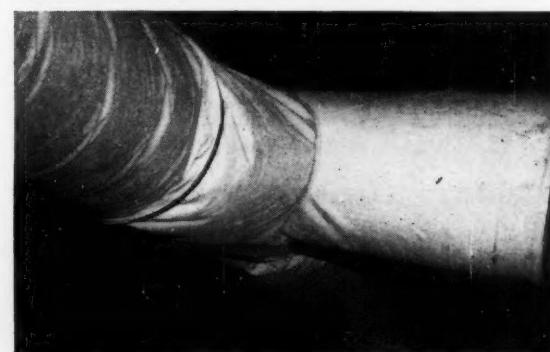
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A.M.C.'s Mining Convention

THE degree of fragmentation obtained from the drilling and blasting phases is the one most important factor in crusher performance and costs, stated James R. Carr, assistant mine superintendent, National Lead Co., Tahawus, New York, who detailed the step-by-step efforts of his company to facilitate the highest crusher performance and the lowest combined drilling, blasting and crushing costs. The potential for improved fragmentation and higher equipment performance varies with each mining operation, it was stated, and can be estimated only through critical examination of the mining and crushing phases of the particular operation. Because of the intimate relationship between fragmentation in the pit and the crusher performance, consideration of crusher performance and costs is essential to the selection of the most economic drilling and blasting techniques, he said. An estimate of the value of higher equipment performance is required in order to determine more accurately how much can be economically spent for improved fragmentation. Both capital and operating costs must be considered.

New trends in underground rail loading and tramping was discussed by James W. Clark, manager, Mining Machinery Division, Lake Shore, Inc., Iron Mountain, Mich., who described some noteworthy advances in underground rail haulage that have caused new concepts in mine plant design. Sectionalised rail sets, light weight, low centre-of-gravity cars, improved maintenance features, automatic loading and dumping devices and remote control of train movements are among these recent improvements. Despite far-reaching developments in conveyors and shuttle cars, some mines which have used trackless equipment are now swinging back to the use of locomotives and cars on track. This is due to several factors, including flexibility of rail haulage, manoeuvrability of drift location, material storage advantages, automation of haulage systems, improvements in loading and dumping, and faster tramping speeds. Improvements in the field of rail haulage and loading have just begun, Clark concluded. The degree to which rail systems can be automated is now outstanding, and present and future developments indicate a further enhancement of the picture.

Automation of a cable tramway system resulted in an operational labour cost cut of 83 per cent, it was reported by Clyde Holen, plant engineer, Northwest Magnesite Co., Chewelah, Wash., who described, with the help of slides, how the ore hauling system of his company, initially installed in 1917, was automated. Despite a number of problems which had to be overcome in the process of automation, the tram is now operating smoothly and efficiently. Crews are constantly making improvements. This automation, it was stated, has resulted in decreased maintenance costs and elimination of numerous work hazards and has contributed effectively to a decrease in over-all labour costs.

Underground mine shuttle cars powered by alternating current (a.c.) electric motors have definite maintenance advantages and are about equal in operating characteristics to shuttle cars using other types of power, according to D. F. Parker, maintenance superintendent, National Potash Co., Carlsbad, N.M. The primary advantage of a.c. power in mobile equipment is the application of the induction motor, which rates low in maintenance as to other types of motors, is rugged, and lends itself rather easily to design of the various shapes required in mobile equipment. The problem of high motor starting torques and rapid accelerations is perhaps more prominent with the induction motor but

Prominent national and state officials and more than 2,500 representatives of the U.S. mining industry attended the 1961 Metal Mining and Industrial Minerals Convention of the American Mining Congress at Seattle, Washington, on September 11-14. Brief summaries of a cross-section of papers are here presented.

must be considered with all types of drives for shuttle cars. Greater advantages are realised when a.c. shuttle cars are used in conjunction with other a.c. mining equipment and power needs are reduced to one easily-handled source.

In large mining operations specialised work such as grouting can best and most efficiently be accomplished by specialised crews, using specific equipment and methods, stated a professor of mining engineering during a panel discussion on grouting.

John J. Reed, professor of mining engineering, Colorado School of Mines, Golden, said that methods used in attacking the grouting problem include research in the literature, laboratory and experimental mine testing, a file of case histories, and advanced planning and supervision on special jobs. The best choice of grouting materials for a particular job must be considered on such factors as cost, applicability and time. On grouting operations where large areas are involved, unusual materials such as inexpensive clays or mill slimes can be effective and economical. Under certain conditions, sequence grouting with different materials one after the other may also be expedient.

A water-soluble mixture of organic chemicals has proved highly successful in grouting to control the flow of ground water in mining shafts, tunnels and drill holes. Victor L. Stevens, manager, Mining Division, Boyles Bros. Drilling Co., Salt Lake City, said that chemical grout would not replace cement or other grouting materials, but would supplement them. In fissured or fractured ground, he stated, "we believe the most effective grouting method would be to use cement or other grouting materials to plug the larger channels first, then follow with chemical grout to close the finer openings and effect the final seal. However, in cases of uniform ground (such as sandstone) where the water is penetrating uniformly, AM-9 chemical grout should do an excellent job". The materials for chemical grouting cost more than for other grouting methods, but this factor is more than offset by the saving in time, resulting in far lower labour costs, in the application of the grout.

Recent technological advances in copper concentration were reported by E. P. Cadwell, chief metallurgist, Mining Chemicals Department, American Cyanamid Co., New York.

Mr. Cadwell said the technological advances had been achieved in three areas — mechanical, operational and chemical. In the field of chemical advances the use of flocculants was probably the newest innovation which had been adopted by the mining industry. In all cases, the use of these chemicals has been to increase the capacity of existing equipment or render its work more effective. In regard to future progress, it was stated that new chemicals were



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being developed which would show a lower overall cost to the mining industry.

U.S. Steel Corporation's project to construct facilities to mine, concentrate and agglomerate the iron ores of the Atlantic City, Wyo., area, was described by A. S. Henderson, process development engineer, Columbia-Geneva Steel Division, U.S. Steel Corp., San Francisco, Calif.

Upon completion, the installation will be the first integrated iron-ore beneficiation plant west of the Mississippi River producing an agglomerated product. The beneficiated and agglomerated ore will be moved 76 miles south of Atlantic City over a company spur to connect with the Union Pacific Railroad for an additional 279-mile trip to the Columbia-Geneva blast furnaces at the Geneva Works in Provo, Utah.

Direct reduction of iron ore by using hydrogen is an economical method of preparing the feed for electric steel-making furnaces that obviates the need for scrap iron in the furnace charge, according to R. J. MacMullan, vice-president, and C. A. Johnson, director of research, Hydrocarbon Research, Inc., New York, who co-operated in the preparation of a paper on "Direct Reduction by the H-Iron Process".

The H-Iron process is a method for making iron by direct reduction of iron ore with hydrogen. The reduction is carried out using finely divided ore in fluidised beds at a temperature below 1,000 deg. F. and a pressure above 200 p.s.i. The low reduction temperature is chosen to avoid stickiness of the iron powder, and elevated pressures are employed to simplify drying the hydrogen and to increase the rate of reduction.

The capital cost of a 500 t.p.d. plant including hydrogen generating facilities was given as \$7,500,000; assuming a price of \$15.60 per gross-ton for ore containing 64 per cent iron and the indicated costs of natural gas and utilities, the total manufacturing cost is \$33.31 per ton of iron.

Digital computers and their application to the mining industry were discussed by James F. Olk, mine superintendent, Pima Mining Co., Tucson, Ariz. In the calculation of

an open pit mine expansion, the end result sought is naturally the economic limit of this expansion. To obtain the desired result, said Olk, certain specific input data is required. While it was initially thought that volume calculations were all that could be computed it transpired that, with the introduction of additional data such as costs, metal recovery and metal prices, the actual economic limit of mine expansion could be calculated by the computer.

High-speed computers, coupled with operations research techniques, will make it possible for the mining industry to develop complex mathematical expressions which simulate complete mining operations, according to E. R. Drevdahl, associate professor of mining engineering, University of Arizona, Tucson. Modern computers, it was stated, will increase the scope of investigations that can be made in all phases of mining engineering. Drevdahl cautioned, however, that the computer is just a tool and the results of any computer work will only be as good as the efforts expended in its utilisation and the ability of the personnel doing the work.

The Anaconda Co.'s preventive maintenance programme, at its Weed Heights, Nev., copper mine and beneficiation plant has resulted in fewer shutdowns due to machinery and equipment breakdowns. A. E. Millar, general manager at Weed Heights, described some of the features of the programme, which involves regular maintenance and inspection to detect potential breakdowns and malfunctions before they occur, thus permitting timely repairing and reconditioning of equipment. In connection with maintenance of haulage trucks, garage staff are experimenting with a shear coupling installed in the drive line immediately behind the transmission. The coupling is designed so that the connecting bolts will break before any damage might result to the transmission. The six units on which this shear coupling has been installed have so far proved very satisfactory, and as soon as the company is completely satisfied with this idea it will be installed on all haulage trucks. In preventive maintenance of shovels used in the open pit, the shovel repair foreman checks each shovel on the day shift whenever it may be idle. In addition, he checks all shovels on Sundays when the mine is closed, and many costly repairs and shutdowns are avoided.

English China Clay

THE decline of tin mining in Cornwall which brought unemployment in its wake was a major disaster for a community which had relied on this once booming industry for more than a century. Where there were hundreds of thriving mines, scattered over a whole county, there are now only two in production.

But there were some who saw a future in another mineral which lay beneath the Duchy's soil—china clay. As the tin mines closed the clay pits opened. A new industry was born. Now the clay pits stretch right across the county and into Devon, producing in enormous quantity a material which is second only to coal in Britain's mineral production figures. The English china clay industry is now producing 1,500,000 tons of raw material a year. Its customers are scattered world-wide and over 60 per cent of its total production goes overseas. Practically every country in the world is on the industry's export books.

English china clay has become one of Britain's biggest foreign currency earners. In the first quarter of this year alone, the Board of Trade returns show that clay worth £2,500,000 was exported. America, which has a large clay-producing industry of its own, is one of the chief customers for English china clay, which is the whitest and finest in the world.

Mechanisation has boosted production to such an extent that expansion promises even greater export achievements in the future. The industry has acquired and developed its own port to handle much of the export trade—the port of Par, on the South coast, near Fowey. Lying in a sheltered bay, Par has grown from a tiny harbour handling little more than an occasional small collier to a thriving port which is now among the busiest in the United Kingdom. New piers completed recently by the china clay interests have made it possible for a dozen ships to berth at a time. China clay is piped in liquid form from the pits to big rotary driers on the quayside, from which the valuable mineral is loaded direct into the ships' holds.

One of the industry's biggest problems has been the disposal of the residues from the production of clay. For every ton of clay produced there are several tons of waste, the major part of which is clean, white silica sand which forms the conical heaps which are a familiar feature of the Cornish landscape.

The sand is processed into a first-class concrete aggregate from which comes the pre-cast building now known throughout Britain as the Cornish Unit dwelling. Already 35,000 Cornish Unit dwellings are inhabited, a major contribution to the post-war housing programme.

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Technical Briefs

50th Anniversary of Froth Flotation

An entirely new application of flotation was described by Antoine M. Gaudin Richards Professor of Mineral Engineering, Massachusetts Institute of Technology, during the international programme of technical papers which was presented in Denver, September 17-20, 1961, at the commemoration of the 50th anniversary of froth flotation in the United States. The event was sponsored by the Minerals Beneficiation Division of the Society of Mining Engineers. The Society is a constituent body of the American Institute of Mining, Metallurgical, and Petroleum Engineers and is the professional organization in the United States for engineers and geologists in the minerals industries.

Professor Gaudin's paper related how two species of micro-organisms have been separated by differential flotation. Results of preliminary tests of the resin-flotation technique in the hydro-metallurgy treatment of natural ores of copper, uranium, and gold have demonstrated the technical and economic feasibility of such a process. It was reported by Roshan B. Bhappu, of Socorro, New Mexico, Metallurgist, State Bureau of Mines and Mineral Resources, New Mexico Institute of Mining and Technology.

The very helpful co-operation of the Mexican government has made possible the extension by many years of active life for the Pachuca mining area. Russell R. Bryan, consulting engineer, Russell Bryan and Associates, reported in a review of operations. The considerable attention in Italy to basic research in flotation was told in a paper by L. Usoni, Director, Consiglio Nazionale Delle Ricerche, Rome. A paper by Dr. I. A. Singewald, of Frankfurt, Germany, discussed the cationic, anionic basis theory of salt flotation. A. Jowett, of the University of Leeds, England, presented a paper on aspects of flotation cell design.

M. Rey and co-authors Société Minière et Metallurgique de Penarroya, Paris, presented a paper on research in the flotation of oxidized ore of copper, lead and zinc. Chief metallurgist Robert W. Hernlund, Pima Mining Co., Tucson, discussed extraction of molybdenite from copper flotation products, pointing out that this method accounts for a fourth of United States molybdenum. A new approach to the analysis of flotation systems was taken up by J. W. H. Chi, Jones and Laughlin Steel Corp. research engineer. O. W. Walvoord, of Denver, summarized items involved in the engineering, design and layout of the flotation section. A total of 31 papers had been scheduled for six sessions.

PRECIOUS ALLOYS IN BRAZING

Recent developments in brazing alloys, including particularly the development of alloys containing palladium, widen the scope of the brazing process and enable it to be used for many operations which formerly entailed welding or mechanical assembly. The main advantages of the newer alloys are strength at high temperatures, low vapour pressure (making them particularly suitable for

high vacuum application), and the ability to join certain materials which cannot be brazed with conventional alloys. In addition to these advantages, the palladium-containing alloys offer minimum erosion of the metals to be prepared, (so that thin sections can be joined), and the ability to join metallized ceramics directly to low expansion alloys.

FLOTATION OF BERYL

A study of the flotation of beryl has recently been published by the U.S. Bureau of Mines (RI.5767) and is perhaps of particular interest in view of the growing interest in beryllium as a structural material as well as for its increased use in atomic energy application.

Working on two samples, one from Connecticut and the other from New Hampshire, it was found that the ores responded to two methods reasonably well. These consisted of either direct flotation of beryl with petroleum sulfonate followed by scrubbing the resulting concentrate with sodium hydroxide to remove the collector and finally floating away any mica using an amine, or

first separating the mica using a cationic collector and subsequently floating the beryl with a petroleum sulfonate.

The work has shown that petroleum sulfonate in an acid circuit is a good collector for the beryl but that additions of fuel oil were detrimental. Hydrofluoric acid, sodium fluoride or fluosilicic acid partially depressed the beryl, although they tended to improve the concentrate grade. Acetic acid was found to be a fair depressant for mica.

SEPARATION AT OTANI, JAPAN

Since re-opening the mine in 1952, the Otani mill of the Awamura Mining Co. Ltd., Japan, has been modified resulting in an increase of 230 per cent in capacity with a saving of more than 57 per cent in the total costs during 1959.

At this mine the chief economic minerals are scheelite, cassiterite, and chalcopyrite and the principal improvements include increasing crushing capacity to 150 per cent by the adoption of wet operation, using heavy media separation more efficiently by reducing the size of feed and employing a mixture of magnetite and ferro-silicon, reduction of over-grinding by replacing the ball mills operated in closed circuit with classifiers; by rod mills and Elliptex screens, improving the separation of the chief minerals and the tailing disposal system. For the separation of the chief economic minerals, differential flotation in combination with electrostatic separation is now employed.

Technical Digest

The mechanism of copper activation in the flotation of pyrite has recently been studied in Japan and the collecting properties of dixanthogen produced by the reaction between the copper and the xanthate examined. As a result it has been shown that both xanthate and dixanthogen show identical effect on the floatability of pyrite under varying conditions whilst considerable amounts of dixanthogen were found in the pulp containing xanthate and dissolved oxygen, which is assumed to act as a collector for the pyrite. (This confirms observations by Rao and Patel—Indian Symposium 1959 and other observations on plant operation). Furthermore, it cannot be expected that dixanthogen derived from xanthate by copper ions is entirely responsible for the copper activation of pyrite.

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Complete automation of heavy media processes, long an objective in coal and iron ore preparation, is reported achieved for the first time in an installation in the Pennsylvania, U.S., anthracite industry.

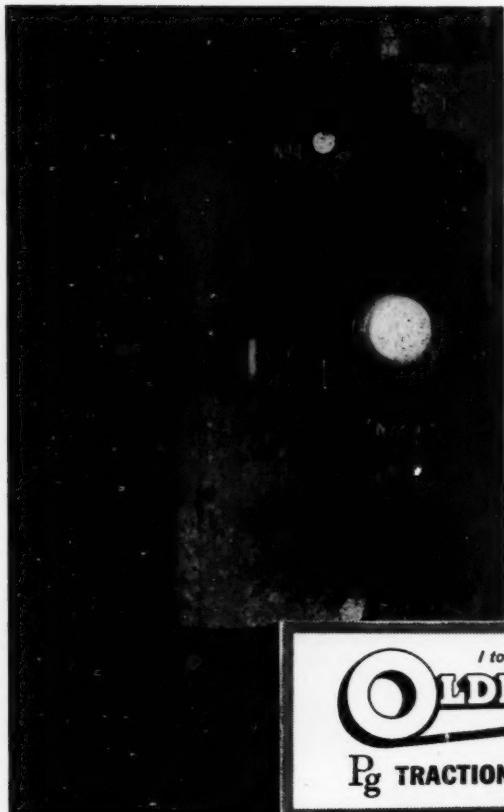
Specific gravity in heavy separation of anthracite coal is held to within ± 0.003 of set point at widest spread with closed loop control system at an installation at Lykens, Pa. The closed loop system is the collaborative development of Wilmot Engineering Company, Brown Instruments Division of Minneapolis-Honeywell Regulator Company, and Industrial Nucleonics Corp. of Columbus, Ohio. Basic principle revolves around use of gamma radiation to measure medium density.

Strategic Materials Corp. reports technical progress on electrothermic reduction smelting and new methods of electrothermic refining. Strategic Materials this year has signed several licensing contracts covering the use of its Strategic-Udy processes by commercial producers. New smelting procedures or new applications of known procedures during the year have included:

A method of improving the yield of low-grade manganese ores with complete control over silicon content and low-power requirements. The high-yield smelting of high-titaniferous iron ores, producing quality iron and good pigment grade titania slag. A method of producing 50 per cent ferrosilicon from siliceous iron ores. A method of recovering molybdenum and tungsten from tool steel grindings. Several new techniques of stainless steel manufacture in continuous molten cycle from the original ore.

*

As a result of investigations conducted at the Indian Institute of Science, Bangalore, tin-copper alloy deposits which are adherent, smooth and fine-grained have been prepared using the pyrophosphate bath. Apart from its non-poisonous character and stability, the electrolytic bath has special advantage as compared with the commercial stannate-cyanide bath. It operates at lower bath voltage and higher current density, the range of deposit-composition is wider (10-96 per cent copper) and cathode efficiency is up to 100 per cent, which is about twice that of stannate-cyanide bath.



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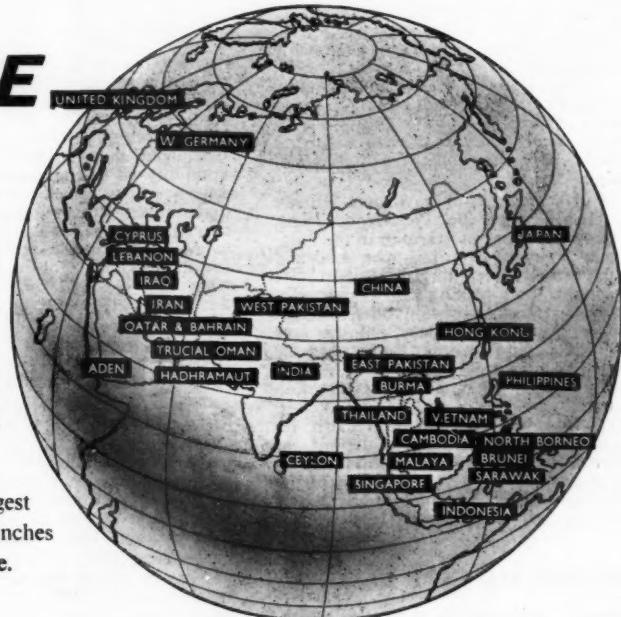
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MINING MISCELLANY

A newly formed Malayan Mining Company, Sungei Siput Iron Mining Co. Ltd., has commenced operations on its first project. The company has acquired leases over 42 acres from Kamuning (Perak) Rubber and Tin Co. Ltd. and over 32 acres of adjoining land from two private owners, about 20 miles north of Ipoh. Combined potential iron ore deposits are estimated at 250,000 tons, and production is planned at 18,000 tons a month. The ore is reported to average 64 per cent to 65 per cent iron content. Initially, the ore will be transported by contract to Prai for shipment to Japan. The directors of the M\$250,000 capitalized company are Mr. J. P. Wilkins (Chairman), Mr. W. R. Hussey, M.B.E. and Mr. D. P. Maher.

★

It is reported from Moscow that the design of a giant oil well has been worked out by the U.S.S.R. Drilling Technique Research Institute. It is planned that the hole of this well will penetrate six miles, or approximately 32,000 ft. The Russians claim that their programme will culminate in the deepest hole ever drilled by man. One of the problems solved by the Institute during the designing of the well was the replacement of steel pipes by light alloy units. A pipe string of special alloy construction is one third the weight of a similar length made of steel, while simultaneously the special alloy construction allows for great strength and a greater heat resistance than that supplied by steel piping. As ground temperature at six miles depth reaches 350 deg. C., these properties assume great importance. The drilling of the well will be accomplished by use of a diamond bit of Soviet manufacture, which has already been made and is at present undergoing tests. In the initial stage of the operation it is intended to utilize rotary drilling, while subsequently operation by turbo and electro drills is planned.

★

Over the first half of the current year, Bulgaria produced 660 tonnes more electrolytic copper, 897 tonnes more lead, 2,221 tonnes more zinc and 557,000 tonnes more hard coal than in the corresponding 1960 period, according to the Central Statistical Administration in Sofia. For comparison, total 1960 production was of 14,000 tonnes of electrolytic copper, 40,000 tonnes of lead, 17,000 tonnes of zinc and 17,125,000 tonnes of coal. During the first half of 1961 two new pits of the State-owned Balkanbas Sliven mining concern were opened; situated at Sheshkingrad and Kichesta, they have a combined annual capacity of 55,000 tonnes of hard coal.

★

Exploratory and study work on uranium deposits in the Bavarian region of Federal Germany have come to a stop as the West German Federal Government has granted no further financial aid for this purpose. Uranium content of Bavarian ores is said to be of up to 0.37 per cent U_3O_8 . A spokesman for the Bavarian mining industry has described the cessation of activities as "regrettable" since all contents above 0.2 per cent U_3O_8 normally count as exploitable.

As a result of recent lay-offs at the Dominion Steel and Coal Corporation's steel plant at Sidney, Nova Scotia, the Nova Scotia Federation of Labour is calling for a Royal Commission to investigate the interests of A. V. Roe Canada Ltd. in Nova Scotia. Dosco is owned by Avro, which is a member of the Hawker Siddeley group.

★

During the first 6 months of 1961 some 132,515 tonnes of bauxite were produced in Italy, as compared with 137,765 tonnes for the corresponding 1960 period. Aluminium output was, however, some 3.9 per cent higher than in the first half of last year.

★

The Iron and Steel Institute of London is to meet in America for the first time since 1904. The scheduled tour of U.S. and Canada will be from October 17-November 8 and will include the American Society for Metals National Metal Congress and Exposition, to be held in Detroit, October 23-26.

★

In Morocco during the first five months of 1961, production of the more important minerals, except petroleum and lead and zinc ores, showed steady increase. The following figures show the tonnages for January to May 1961 with the figures for the corresponding period in 1960 shown in parentheses. Anthracite 176,596 tons (172,161), petroleum 32,668 (40,695), phosphates 3,336,923 (2,987,406), lead ore 48,658 (56,959), zinc ore 27,785 (37,008), manganese 179,505 (150,947), iron ore 644,019 (612,255), cobalt 5,449 (5,439).

★

Present indications are that a copper ore body at Whalesback Pound, in Newfoundland, warrants mining, it was announced at the eighth annual meeting of British Newfoundland Corporation Ltd. The chairman, Mr. H. G. Smith, told the shareholders that a decision whether to take the next step, further underground exploration to determine the extent and nature of the ore reserves—will be made shortly. Such further exploration would determine the scale and approach to any mining operation which might be undertaken and would require upwards of 12 months. Work on the prospect is being done by BRINCO's mineral exploration subsidiary, British Newfoundland Exploration Limited under a joint venture agreement with Anglo American Corporation of South Africa Limited.

★

A National Mineral Collection has been established at Ottawa and contains some 50,000 mineral specimens from Canada and from all over the world. The project is sponsored jointly by the Department of Mines and Technical Surveys, in which the Geological Survey operates, and by the Department of Northern Affairs and Natural Resources, which controls the National Museum. The collection will consist of two series, one for reference and one for display. Officials of the two departments will be constantly adding to it, while mining companies and individuals are being invited to contribute specimens of interest.



At the Leyland factory of BTR Industries Ltd. radio-active gauges record and control the thickness of PVC coating being applied to fire-resistant underground conveyor belting. Some 4,500-ft. of similar PVC belting—incorporating a continuous filament nylon stress member with a cotton cover warp and continuous filament nylon weft—has been supplied by BTR for Pit House Drift, Durham one of the N.C.B.'s largest and most important installations. This newly patented method of construction represents a major departure from conventional methods of manufacturing conveyor belting

Negotiations between the Koppers International Co. and the Greek Industrial Development Corporation (I.D.C.) for the establishment of an iron and steel works have resulted in the signing of an agreement at Pittsburgh, whereby Koppers have agreed to compile a survey of the project at their own expense. If this survey, together with the engineering plans and conditions, is approved by I.D.C., an agreement of co-operation will be signed with Koppers which will also provide for the participation of Koppers in the newly formed Iron and Steel of Greece S.A. Meanwhile I.D.C. reserves the right to carry on negotiations with other interested parties. Under the agreement I.D.C. retains the right to select and obtain material and plant directly and without the mediation of Koppers. The formation of Iron and Steel of Greece S.A. was announced in our issue of Sept. 1, 1961, p. 205.

★

A delegation from the European Coal and Steel Community, led by Monsieur G. Michel, Director of the Industrial Problems and Reconstruction Department of the High Authority, has been paying a six day visit (October 1 to October 6) to study colliery management training in the U.K. coal industry.

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Metals and Minerals

Metals in the Crystal Ball

Two forecasts of future trends in world demand for metals have been made by U.S. experts. On the whole, their prognostications are encouraging, though not necessarily so for individual metals or producers.

The short-term outlook was discussed by Mr. Erik Windmiller, assistant vice-president of Apex Smelting Co., who considers that the demand for most non-ferrous metals should increase substantially next year over 1961. This prediction, made at a session of the National Industrial Conference Board in New York, relates primarily to the U.S. and is based largely on the higher rate of production expected for motor cars, appliances, electrical equipment, most durables, a higher level of building construction, and enlarged military demands.

Mr. Windmiller coupled his forecast with a warning that "all would not be rosy for every metal company". Competition between individual metals and different companies would be even more intense and there was likely to be a narrowing of profit margins.

In the past few years, he stated, metal production facilities had been expanded and made more efficient both in the U.S. and elsewhere in the Free World. As quoted in *American Metal Market*, he expects neither full capacity operations nor shortages during the coming year, although some temporary shortages or dislocations might develop for one or more metals as the result of international or labour difficulties outside the U.S. Should such dislocations become serious, it was pointed out, government stockpiles

are far more than adequate to meet emergency situations.

Particularly encouraging for zinc producers at a time when L.M.E. prices have been under increasing pressure, is Mr. Windmiller's statement that this metal is "having a lively comeback in the auto field" because of better plating techniques and research on galvanized sheet. Zinc is even edging out new plastics in some areas. Mr. Windmiller also indicated enlarged sales for nickel and its alloys in 1962.

The long range outlook was discussed at the same meeting by Mr. Thomas T. Fleming, vice-president of marketing of the Howe Sound Co. His main theme was that primary producers of major metals would have to be less "commodity-minded" with respect to their specific metals and would have to change their old concepts of operating in narrow channels. The question they would have to consider was: "what must be produced?"

Mr. Fleming noted that the basic metal industries had felt various degrees of overcapacity on their profit margin, but that the impact on aluminium and copper had been more pronounced than on the steel interests, which, he stated, tend to have better co-ordinated leadership and to keep the reins on pricing patterns. He is of the opinion, however, that modest increases may be expected in the prices of metal over the next decade, including those of steel and aluminium.

An intensification of intra-metal competition during the next decade was pre-

dicted. To combat this competition much research will be devoted to the development of new alloys and composites for specialized uses. Metals will also continue to feel rising competition from plastics, reinforced plastics, fibreglass, and perhaps other materials. This will compel major metal firms to forget their historic patterns of marketing and to consider entrance into other areas—steel producers, it was suggested, will perhaps look at the production of light alloys. The major metal producers will also be giving more attention to the expanding market for clad metals and metals coated with non-metallic materials. They will venture more and more into composite materials, so as to obtain the best properties of each material in the composite.

In conclusion, Mr. Fleming expressed the view that the new metal producing companies would be "more adventurous" and more flexible—they would no longer be restrained by the philosophy of marketing mainly a single metal.

ACCRa DIAMOND MARKET

The eight companies operating on the Accra diamond market in Ghana have agreed to pay 1 per cent commission to the Diamond Workers' Co-operative Union for handling their members' diamonds. The Co-operative, which claims that all Ghanaian diamond winners are members of the union, has agreed in return to give up its licence as diamond dealers on the Accra market. This means that its business, amounting to approximately one-ninth of the market, will be absorbed by the other eight firms. Local diamond winners supply about half Ghana's total production. The 1 per cent commission paid to the Co-operative will cost the companies about £50,000 a year. The money will be used to improve the methods and yields of member firms.

LONDON METAL AND ORE PRICES, OCTOBER 5, 1961

METAL PRICES

Aluminium, 99.5%	£186 per ton
Antimony—	
English (99%) delivered, 10 cwt. and over £230 per ton	
Arsenic, £400 per ton	
Bismuth (min. 1 ton lots) 16s. lb. nom.	
Cadmium 11s. 0d. lb.	
Cerium (99%) net, £15 0s. lb. delivered U.K.	
Chromium, Cr. 99% 6s. 11d./7s. 4d. lb.	
Cobalt, 12s. lb.	
Germanium, 99.99% Ge. kilo lots 2s. 5d. per gram	
Gold, 250s. 0d.	
Iridium, £20/£23 oz. nom.	
Lanthanum (98%/99%) 15s. per gram	

Magnesium, 2s. 2½d./2s. 3d. lb.
Manganese Metal (96%/98%) £275/£285
Nickel, 99.5% (home trade) £660 per ton
Osmium, £17/£22 oz. nom.
Osmiridium, nom.
Palladium, Imported, £8 12s. 6d.
Platinum U.K. and Empire Refined £30 5s.
Imported £27 7s. 6d./£27 17s. 6d.
Quicksilver, £62 ex-warehouse
Rhodium, £43/£45 oz.
Ruthenium, £14/£16 oz. nom.
Selenium, 46s. 6d. per lb.
Silver, 79½d. f. oz. spot and 80½d. f.d.
Tellurium, 37s. 6d. lb.

ORES AND OXIDES

Antimony Ore (60%) basis	30s. 0d./33s. 0d. per unit c.i.f.
Beryl (min. 10 per cent BeO)	270s./275s. per l. ton unit BeO
Bismuth	30½s. 0d. 1b. c.i.f.
Chrome Ore—	20½s. 3s. lb. c.i.f.
Rhodesian Metallurgical (semifriable 48%) (Ratio 3 : 1)	£15 5s. 0d. per ton c.i.f.
" Hard Lumpy 45% (Ratio 3 : 1)	211 10s. 0d. per ton c.i.f.
" Refractory 40%	£11 0s. 0d. per ton c.i.f.
" Smalls 44% (Ratio 3 : 1)	213 5s. 0d. per ton c.i.f.
Pakistan 48% (Ratio 3 : 1)	£11 15s. 0d. per ton f.o.b.
Columbite, Nigerian quality, basis 70% combined pentoxides (Ratio 10:1)	Nb ₂ O ₅ : Ta ₂ O ₅ 150s./160s. 0d. per l. ton c.i.f.
Lithium Ore—	
Petalite min. 3½% Li ₂ O	50s. 0d./55s. 0d. per unit f.o.b. Beira
Lepidolite min. 3½% Li ₂ O	76s. 0d./80s. 0d. per unit f.o.b. Beira
Amblygonite basis 7½% Li ₂ O	75s. 0d./85s. 0d. per ton f.o.b. Beira
Magnesite, ground calcined	£228 0s./£30 0s. d/d
Magnesite Raw (ground)	£21 0s./£23 0s. d/d
Manganese Ore Indian—	
Europe (46%–48%) basis 60s. 0d. freight	73d./75d. c.i.f. nom.
Manganese Ore (43%–45%)	69d./71d. c.i.f. nom.
Manganese Ore (38%–40%)	nom.
Molybdenite (85%) basis	10s. 0d. per lb. (f.o.b.)
Titanium Ore—	
Rutile Australian 95/97% TiO ₂ (prompt delivery)	£25 10s. per ton c.i.f.
Ilmenite Malayan 50/52% TiO ₂	£11 10s. per ton c.i.f.
Ilmenite Travancore 58/60% TiO ₂	£15/£15 10s. per ton c.i.f.
Wolfram and Scheelite (65%)	120s. 0d./123s. 0d. per unit c.i.f.
Vanadium—	
Fused oxide 95% V ₂ O ₅	7s. 6d./8s. per lb. V ₂ O ₅ c.i.f.
Zircon Sand (Australian) 65–66% ZrO ₂	£16 ton c.i.f.

LONDON QUICKSILVER MARKET

At £62 per flask ex-warehouse, the London quicksilver market looks reasonably steady. The big question yet to be answered, however, is whether it can generate sufficient energy within the next two or three months to sustain the current price.

Demand for the metal outside of contractual obligations admittedly still leaves plenty of room for improvement but both Spain and Italy are seemingly unwilling to press sales. Moreover, United Kingdom imports during August were exceptionally small at about 320 flasks, according to Board of Trade statistics; the usual monthly intake is between 2,000 and 3,000 flasks.

The availability of Russian and, more recently, Chinese metal, could continue to keep the market unsteady, some quarters feel, unless demand generally, and in the United States in particular, broadens sufficiently to absorb some of the slack from the smaller producers.

At the moment there is little hope of this happening within the near future. If conditions remain as they are now, the influx of Chinese metal which is expected may be difficult to accommodate without disturbing the market. It is believed that some Chinese quicksilver is due to arrive here shortly, and that arrivals in the course of the next three months could total several hundred flasks, some of which almost certainly would be available for sale. Prices as low as £57 per flask c.i.f. have been mentioned for

Chinese, though probably much depends on the quantity involved.

GREEK-FRENCH AGREEMENT ON LARYMNA MINES

Final agreement has been reached between the French firm of "Le Nikel" and the Hellenic Chemical Products and Fertilizers Company Ltd., for the establishment of a corporation to operate and process the iron and nickel deposits of the Larymna mines for the production of nickel and steel. A preliminary agreement was signed last August and approved at the time by the Ministry of Industry. In the newly established corporation, the French firm will have a 20 per cent equity participation while the fertilizer company will retain a controlling interest of 80 per cent.

The new company will maintain the closest co-operation with "Le Nikel" both in the technical and the commercial domain. The present facilities of the Hellenic Chemical Products and Fertilizer Co. at Larymna will be completed so as

to raise the plant's production capacity to 4,000 tons of nickel and 90,000 tons of steel annually.

The former Industry Minister, Nickolas Martis, has stated that the Greek economy will benefit by the above mentioned project to the extent of \$14,000,000 annually.

DERBYSHIRE MAGNESIUM PLANT

Magnesium Elektron Ltd. have appointed the Power-Gas Corporation Ltd., of Stockton-on-Tees, a member of the Davy-Ashmore Group, to be the main contractors for the engineering of a new plant to produce 5,000 tons of magnesium per annum at Hopton, near Wirksworth, in Derbyshire. (See *The Mining Journal*, September 8, 1961, p. 241).

The plant will extract magnesium of 99.9 per cent purity from local dolomite by a process not previously operated on a commercial scale in Britain. The value of the completed plant to Magnesium Elektron is expected to be around £2,000,000.

Magnesium Elektron is now a wholly owned subsidiary of British Aluminium.

CHINESE GOLD ON LONDON MARKET

Since China despatched ten bars of gold to the London bullion market for assaying towards the end of August (the metal was declared "good delivery" as from October 2) there has been considerable speculation regarding potential future supplies. According to information received by the China Association, however, supplies of Chinese gold in any quantity are unlikely in the immediate future.

So far at any rate the Chinese preliminary move to have their metal tested for fineness, homogeneity and construction has caused slight reaction in the London market.

Of course, there must be large stocks of secondary gold in China as indeed there must be of silver but they might be more difficult to uncover. Certainly China could well use foreign exchange to pay

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for her imports of grain from Canada, Australia and elsewhere. That has been the main reason for Chinese silver coming onto the market. It has been estimated that already this year sales of Chinese silver on the London market have been double the total of 10,000,000 oz. supplied in 1960.

U.K. WOLFRAM MARKET

An uncertain tone prevails in the wolfram ore shipment market presumably because of the recent break in the price. Buyers have largely withdrawn and in the virtual absence of business a range of 120s. to 123s. per long ton unit c.i.f. Europe appears to be a fair assessment of the price compared with 122s. to 125s. previously.

MANGANESE IMPORTS

The Board of Trade has announced that they are considering an application for the exemption from import duty of electrolytic manganese metal of purity not less than 99.5 per cent and of manganese nitride containing not less than four per cent by weight of nitrogen in all.

Requests for a statement of the case should be addressed to the Board of Trade, Tariff and Import Policy Division, Horse Guards Avenue, London, S.W.1 not later than October 18, 1961, and interested parties must undertake to treat the information as confidential. Comments on the statement should be sent to the same address by October 25.

*

Concessions for stepping up exports of Indian manganese ore will shortly be announced by the government, possibly in the form of reduced railway freight charges from the mines to the ports, and

reductions in royalties and port charges.

At a resumed meeting in New Delhi on September 23 between the manganese mine owners and exporters, and officials of the Commerce and Industry Ministry, the former are understood to have stated that the price of Indian manganese ore was four dollars more per ton than the international price. If India was to compete successfully and regain some of her sales instead of the present barter system, lost markets, the mine owners urged that government concessions should reach the figure of four dollars per ton. If they were given the concession they wanted, it would be possible to revert to cash sales instead of the present barter system.

NO SHORTER WEEK FOR AUSTRALIAN MINERS

The Commonwealth Arbitration Commission has dismissed claims by the Australian Workers Union for a shorter working week for miners of metals. The Union sought a 30 hour week for underground workers at the gold, tin, wolfram, lead, zinc and copper mines in Victoria and Tasmania.

For surface workers at those mines and the allied smelting works, the Union asked for a 35 hour week.

The Commission said they were not convinced that the nature of metal mining or the circumstances in which it was performed justified any reduction in hours.

JAPANESE MINERAL IMPORT LIBERALIZATION

Nickel imports into Japan were liberalized as from the first of this month, according to a statement by the Japanese Ministry for Foreign Trade and Industry. The liberalization of copper, lead and zinc is expected to follow in twelve months' time.

Copper • Tin • Lead • Zinc

(From Our London Metal Exchange Correspondent)

Stocks in U.K. official warehouses at the beginning of the week were higher in the case of copper and zinc and lower in the case of tin and lead.

COPPER RECOVERS ON U.S. DEMAND

Copper stocks in U.K. official warehouses rose by 250 tons to 22,594 tons. On the L.M.E. the contango on this metal has halved and is now about 40s. Prices were depressed initially as a result of the rise in stocks, discouraging close in U.S. futures and lack of interest generally. Recovery took place later due to a natural reaction and more encouraging advices from the U.S. On the week prices have risen by about 4d. for cash and 2d. for forward metal. Continental interest has been rather better, whilst some reports refer to enquiries from China.

From Santiago it was learned that a hitch had developed in the negotiations between the Andes Copper Mining Co. and representatives of the Potrerillos and El Salvador workers. Demands for a new labour contract for Chuquicamata workers delivered to Anaconda are said to include a 40 per cent general increase plus fringe benefits. At Mount Isa,

where the mine has been closed since September 25, no agreement has been reached over the bonus negotiations and neither Union officials nor the Industrial Commissioner are optimistic about a settlement. The strike of machinists which has shut down Inspiration Consolidated Copper Co.'s mines and plants in Arizona continues, and no arrangements have yet been made for negotiation or mediation.

From New York it is learned that the Cartaret Refinery has had to shut down a reverberatory furnace due to shortage of supplies of concentrates and ores because of Japanese competition. In the U.S. the buying price for scrap copper has been reduced by 1d. to 25d. per lb.

TIN PRICES DECLINE

Tin stocks in U.K. official warehouses fell by 86 tons to 5,238 tons. On the L.M.E. the contango has widened to about £13, and prices have fallen by about £12 for cash and £7 for forward metal. The announcement by the G.S.A. that bids would be accepted for the sale of a further 1,000 tons has been an unsettling factor, whilst Continental interest has latterly been rather quiet.

Tin shipments in September from

Penang are reported as 7,689 tons and from Singapore as 12½ tons. The corresponding figures for August were 6,620 tons and 2½ tons.

On Thursday the Eastern price was equivalent to £959½ per ton c.i.f. Europe.

LITTLE CHANGE IN LEAD

Lead stocks in U.K. official warehouses fell by 5 tons to 10,629 tons. On the L.M.E. there has been little change over the week in contango or price, and for the time being there appears to be little to alter the position.

The formation of a European Lead Development Committee to expand consumption has been announced. The Committee's activities will include the publication of technical and promotional literature in French, German, Italian and English.

Of interest is the statement that consumption of lead in Europe in the four years to the end of 1960 rose by about 11 per cent and that this growth has continued in the first half of 1961.

ZINC PRICES REMAIN STEADY

Zinc stocks in U.K. official warehouses rose by 362 tons to 7,197 tons due to the registration of a further point of delivery. On the L.M.E. prices have remained steady with the contango now standing at about 5s. Strikes and short-time working in the U.K. motor industry, together with some deliveries of Russian zinc, have helped to keep prices down. There seems little at the moment to alter the position, but the strike at Fords in the U.S.A., if prolonged, could have a further depressing effect.

From Washington it is announced that President Kennedy has signed the Bill to subsidize the production of lead and zinc by small U.S. producers. The subsidy is to be paid on not more than 3,000 tons of both metals in the first year of the programme, declining to 1,200 tons in the fourth year. The Bill guarantees the mines a combined price of 29c. per lb. (14½c. per lb. for each metal) beginning in 1962 and ending in 1965.

OFFICIAL TURNOVERS

Official turnovers (in l.tons) for the week ending September 29, 1961, with the previous week's figures in parentheses, are :

	September 28 Buyers	Sellers	October 5 Buyers	Sellers
COPPER				
Cash	£225½	£225½	£229	£229½
Three months ..	£229	£229½	£230½	£230½
Settlement ..	£225½		£229½	
LEAD				
Current ½ month	£63	£63½	£63	£63½
Three months ..	£64½	£65	£64½	£65
TIN				
Cash ..	£960	£961	£942	£943
Three months ..	£968	£969	£953	£954
Settlement ..	£961		£943	
ZINC				
Current ½ month	£73½	£73½	£72½	£72½
Three months ..	£73½	£74	£73½	£73½

Closing prices are as follows :

	September 28 Buyers	Sellers	October 5 Buyers	Sellers
COPPER				
Cash	£225½	£225½	£229	£229½
Three months ..	£229	£229½	£230½	£230½
Settlement ..	£225½		£229½	
LEAD				
Current ½ month	£63	£63½	£63	£63½
Three months ..	£64½	£65	£64½	£65
TIN				
Cash ..	£960	£961	£942	£943
Three months ..	£968	£969	£953	£954
Settlement ..	£961		£943	
ZINC				
Current ½ month	£73½	£73½	£72½	£72½
Three months ..	£73½	£74	£73½	£73½

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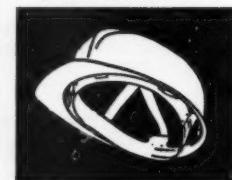
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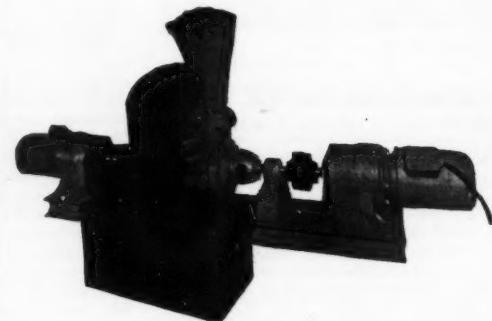
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Mining Finance**A New Rio Algom**

New proposals have been announced that will add considerably to the power and sphere of influence of Rio Algom. An offer has been made by Rio Algom to purchase the technical and administrative organizations of the Rio Tinto Mining Company of Canada, together with its exploration and development programme and certain other assets. The assets include the shares held by R.T.M.C. in Anglo-Rouyn Mines, Oceanic Iron Ore, Rix-Athabasca Uranium, Tinto Iron Mines, Brunswick Mining and Smelting, Rio Tinto Canadian Exploration, and Rio Tinto Dow Ltd. R.T.M.C. will also sell its African interests to Rio Algom. The total cash consideration paid by Rio Algom, including \$1,566,000 for the African interests, will be \$7,066,000.

It is a condition of the offer that Rio Tinto, London, and its Canadian subsidiary Tinto Holdings will, for 15 years, refer to Rio Algom any business opportunities which come to their knowledge in Canada and Rio Algom will reciprocate in terms of any opportunities it may have in the United Kingdom. Tinto Holdings, in consideration of its covenant, will be granted an option to purchase 500,000 Rio Algom shares at \$9.20 up until January 1, 1965.

Rio Algom, it will be recalled, was formed on June 30, 1960 to amalgamate the four uranium mines in the Rio Tinto group, Algom itself, Milliken Lake, Northspan and Pronto. Following the announcement in November 1959, by the Atomic Energy Commission in the U.S.A., that it would not exercise its options to purchase uranium concentrates after the termination of the existing contracts, the mines faced the prospect of either an abrupt ending of uranium production or alternatively a reduction in output in order to enable some mines to remain in production until 1966. The four Rio Tinto companies decided to reduce output and were amalgamated under Rio Algom as the best way of scaling down production was by the merging of the four contracts. Rio Algom also arranged, through cash payments, to produce and deliver substantially all of Stanleigh's Eldorado contract undelivered at August 31, 1960 and thus at the time of its formation Rio Algom had contracts for the sale of uranium concentrates equal to approximately 33,210,000 lbs.

It has also been announced that Tinto Holdings have offered to purchase from present shareholders of Preston Mines their common shares in Preston at \$7.20 (Canadian) per share. The offer is open until October 31, 1961 and is conditional upon the acceptance of a minimum of 750,000 shares and a provisional maximum of 1,250,000 shares.

Before these proposals were announced R.T.M.C. was the Rio Tinto group's development arm in Canada whilst Rio Algom was the main revenue earner. It is not surprising then, that these functions should have been brought together under one head and it is through Rio Algom that it is being done. Between now and the end of the existing uranium contracts in 1966 there will be a large cash flow into Rio Algom. In its latest quarterly report it announced that its long-term indebtedness had been reduced to only \$4,214,000 compared with almost \$80,000,000 when the company was formed, and it has been estimated that

after all these debts have been cleared there will be a net cash inflow in the order of \$130,000,000. With these financial resources and the R.T.M.C. technical and administrative services this will be a powerful company indeed.

The beneficial interest of Rio Tinto, London in Rio Algom is a little over 37 per cent of which 30.6 per cent is held through Tinto Holdings, which owns 63 per cent in Preston, which in turn owns 46.83 per cent of Rio Algom. The significance of the offer for Preston common shares is that a purchase of a further 1,250,000 shares will increase its holding to almost 83 per cent and will thus raise its beneficial holding in Rio Algom to around 50 per cent.

These arrangements should please shareholders of both Rio Algom and the London Rio Tinto company. No longer is Rio Algom dependent upon the "hidden" uranium contract for its life after 1966 and, as far as the parent is concerned, this is a further diversification reducing the dependence upon the Central African copper profits which last year accounted for almost 54 per cent of the consolidated profits before taxation.

These considerations are independent of any thoughts of uranium after 1966 and Rio Tinto believes in the future of uranium. Already it is participating with Rolls Royce and I.C.I. in a new company to operate in the field of fuels for civil nuclear engineering and it has a similar participation with a large German company.

OFSITS IN EXCHANGE FOR LYDENBURG

The announcement of the offer by the Anglo American Corporation to the stockholders of Lydenburg Estates is not really surprising. The offer is of one Ofsit share for every five stock units of Lydenburg Estates held. At the time the announcement was made, the London price of the Lydenburg stocks was 10s. 3d. cum dividend compared with the Ofsit price of 57s. 6d. The offer made the Lydenburg stocks worth about 12s. 3d. allowing for the dividend.

The Ofsits shares that will be required for this offer are to be made available from Anglo American's investment holdings in the Trust and therefore this will not involve any increase in the Ofsit capital.

The offer is made exclusive of the Lydenburg dividend for the year ended June 30, 1961 and in order that the dividend may be paid before the offer opens a special interim dividend of £s. 3d. has been declared in respect of that year and will be payable to members registered on October 6. This special interim is the same as that declared for the previous year. No further dividend will be paid in respect of the year ended at June 30 last.

The preliminary accounts of Lydenburg Estates show that the profit before taxation has increased from £37,566 to £46,296 when compared with the previous year. However, in the earlier year the profit was arrived at after depreciation of investments whereas in 1961 depreciation has been charged to the general reserve; making allowance for this change

(continued overleaf)

London Market Highlights

After a rather uninspiring start on Monday, South African gold shares became a much happier market as the week wore on. Business was still very limited, but the mere presence of buyers was enough and some sharp price gains were registered on Wednesday. Initially a demand for the O.F.S. issues led to an improvement no doubt in anticipation of the quarterly reports which are due next week.

Free State Geduld came to life on Wednesday with a spurt of 3s. 9d. to 83s. 9d. and Welkom showed a rise on the three days of 1s. 3d. at 13s. Loraine's gain of 1s. to 18s. 6d. was more directly linked with the excellent monthly profit. Other firm spots included Western Holdings at 11s. 3d., President Brand at 50s. 7½d. and, when the movement broadened, West Driefontein at 75s. and Union Corporation at 45s. 6d. An exception to the trend was the sharp setback of 6s. 10½d. to 89s. 4d. which occurred in Selection Trust; dealers were not prepared to make much comment on the movement and the inference was that a large parcel of stock—possibly from a deceased estate—had come on to the market.

Helped by an improvement in the metal price, copper shares, too, began to look brighter. There were also hopes that the imminent "Anglo" group final dividends would be maintained and it needed only a trickle of buyers to lift prices. Rhokana were firmest of all with a jump of 2s. 3d. to 45s. 9d. and smaller gains were seen in Nchanga at 44s. 3d. and Rhodesian Anglo at 54s.

Elsewhere in the mining markets the Australian lead-zincs looked very weary indeed when the metal prices took a tumble on Monday, and although the metals subsequently rallied, share prices stayed in the doldrums. New Broken Hill were particularly depressed with a fall of 3s. to 46s. and Consolidated Zinc showed a net loss of 2s. 9d. at 61s. 3d. There was some consolation, however, in the fact that the South and North Broken Hill mines held comparatively steady after the previous setback which had followed news of the pending rights issues for the Alcoa aluminium project.

Tins took a tumble when on Monday and Tuesday Singapore showed that the recent indigestion in that centre had not yet been fully cured. Prices steadied by Wednesday, but not until Tronoh had come back 5s. to 63s. during the three days and Ayer Hitam had lost a similar amount to 42s. 6d. with Sungai Besi 3s. down at 40s. Little patches of brightness, however, were provided by Rantau, 1s. up at 11s. on the excellent dividend, and also by London Tin which kept firm at 16s. 10½d. on hopes of an increase in the pending interim.

The complicated details of the Rio Algom offer for most of the Rio Tinto of Canada assets had the market guessing for a while on Monday. Eventually, the former shares were marked up by ½ to \$16½ and the latter rose ½ to \$1½. Otherwise, the shadow of Ghana politics obscured Ashanti's latest record profit and the shares eased to a new low of 10s. 10½d. while those of "Casts" lost 9d. to 15s. 9d.

the profit, before taxation, has only been increased by £1,335.

The directors of Lydenburg Estates are recommending that stockholders should accept the offer and have stated that full details will be published as soon as possible. Shareholders should await these full details before judging the offer.

TRONOH MINES SCRIP ISSUE

The board of directors of Tronoh mines have decided to recommend that the authorized capital of the company should be increased to £2,250,000 and that the sum of £1,075,187 from reserves should be capitalized. This means the capitalization of the share premium account and a portion of the general reserves amounting to £616,291.

If these recommendations are accepted, then shareholders will receive one new fully paid share of 5/- for each share held on September 21, 1961. An extraordinary general meeting to discuss these proposals will be held on the same day as the annual general meeting, October 13.

The report and accounts for the year ended December 31, 1960 show that, although only the final quarter of the year was completely free from export restriction, the revenue from the sales of tin concentrates increased to £1,559,085, compared with £1,022,042 for the previous year. Similarly the interest and dividends received increased from £100,871 to £222,661. The dividends for the year, including the recommended final, total 5s. 3d. per share or £691,480 compared with the net profit after taxation of £713,989.

TWO YEARS AT CLUTHA RIVER

Clutha River, the New Zealand gold dredging company, has had a successful year and the directors have been able to recommend a final dividend of 1½d. bringing the total for the year to 2d. per share compared with 1d. for the previous year. The profit for the year has more than doubled from £6,273 to £13,051 as a result of the increased amount of gold recovered. In total some 8,133 ounces of bullion were recovered during the year and this is the best ever excepting only 1938 when 8,241 ounces were recovered from the Clutha River. However, the increased revenue from this high level of production was partly offset by an increase of over £9,000 in operating costs. This was due mainly to the heavy expenditure on repairs to the stacker equipment and the replacement of the bottom tumbler. The power costs have also increased.

These continually increasing costs have meant that a proportion of the company's area is no longer profitable to work and thus whilst the areas held under licence would take some five years to work out, the working of the payable ground will probably be completed in a little under two years. There seems little likelihood of securing any additional payable ground.

Capital returns have already been made and at present the par value of the shares is 1s. 5d. At the date of the balance sheet, March 31, 1961, the net current assets were worth almost 1s. 1d. per share and whilst it is a difficult problem it may well be possible to eventually dispose of the dredge advantageously. It is not an ultra-deep digging dredge but it is a sufficiently deep digger to be of interest to the Malayan tin industry should they require one.

Extracts from the chairman's statement are published on page 356.

LONRHO EXPANSION

Lonrho's expansion plans, which were discussed in detail in *The Mining Journal* of September 1, have been approved at an extraordinary meeting held in London. Resolutions were passed to increase the company's capital from £1,000,000 to £2,000,000 by the creation of 4,000,000 new ordinary shares of 5s. each. Of the new shares 1,500,000 have been allotted to Shepton Estates and a further 2,000,000 shares are being held available for issue in satisfaction of the option granted to Shepton Estates. The remaining 500,000 new shares will be held in reserve.

Shepton Estates (Private) is Mr. R. W. Rowland's company and if the deal is completed then Mr. Rowland will control 46½ per cent of the issued capital of Lonrho.

CEMENTATION PROFITABILITY IMPROVING

In April this year the chairman warned that he could not hold out any hope of an ordinary dividend for the year ended March 31, 1961 and this has turned out to be the case; the group results show a net trading loss after depreciation of £202,274. Overall, the year to last March has entailed a drop in the group's reserves of £905,000; this is made up of a loss, after depreciation and taxation of £434,903, provision and write-off equal to £425,144, and preference dividends of £45,631. The main provision is one of £250,000 to meet contingencies arising from overseas operations.

The preliminary results for the first five months of this year to August 31 are encouraging, and indicate a net profit after all charges including taxation of £150,000. A net loss of £100,000 was incurred during the same period of the previous year. The board have pointed out that due to the nature of the contracting business, it cannot be assumed that this trend will be continued throughout the year but there is good reason for "sober optimism". Certainly the preference dividend should be covered by profits, though the ordinary shareholders will probably have to wait a while yet. The last ordinary dividend was 12½ per cent paid in respect of 1958-1959.

NORTH BROKEN HILL PROFITS DOWN

The North Broken Hill preliminaries showed that the profit after taxation for the year ended June 30, 1961, has fallen by £A230,000 to £A1,020,000. This is due to a combination of factors. The mine revenue has fallen, the operating costs have risen and there has been a drop in the investment income. The greatest drop is in the income from mine production which has fallen from £A4,586,000 to £A4,362,000. In June of this year an interim dividend of A5d. per share was paid and now a final of A7d. has been declared, bringing the total for the year to Als. compared with an equivalent of Als. 1d. for 1960. The 1960 interim dividend was declared before the scrip issue.

A MALAYAN CURRENCY

At present, Malaya has a common currency with Singapore and Britain's Borneo Territories issued by a common Currency Board, but Malaya is actively studying the question of its Central Bank

issuing its own currency. However, if the project of Malaysia came about the problem would solve itself. Malaysia is a plan put forward by the Federation Prime Minister, Tunku Abdul Rahman, for closer political ties between Malaya, Singapore, North Borneo, Brunei, and Sarawak.

Financial News and Results

Kinta Kellas Tin.—Extracts from the chairman's statement are published on page 356. The company's report and accounts and the chairman's statement were discussed in these columns on September 15, 1961.

Anglo American Interim.—An interim dividend of 40 c. (4s.) has been declared in respect of the year ending December 31, 1961. This is the same as the previous year. The effective rate of non-resident shareholders' tax is 5.55 per cent.

Kentan Gold Areas.—On page 356 extracts from the chairman's statement are published. This statement, together with the report and accounts, was discussed in *The Mining Journal* on July 27 and September 15, 1961.

African and European Investments.—The interim dividend for the current year has been maintained at the previous year's level, 20 c. (2s.). The rate of non-resident shareholders' tax is 7.5 per cent.

Coming Events

A symposium on mechanization of mines will be held from December 9-12, 1961, at the Central Mining Research Station, Dhanbad, India. Simultaneously there will be an exhibition of mining machinery and equipment, which will continue until December 22. Delegates from ten different countries are participating in the symposium. The accommodation, transport etc., for all foreign delegates at Dhanbad has been arranged. Anyone still intending to attend the symposium should immediately register their names with the Hon. Secretary, Mechanization of Mines Symposium, c/o *Journal of Mines, Metals and Fuels*, 6-2 Madan Street, Calcutta 13. (Cable TEKJOURN, Calcutta.)

The Institute of Mining and Metallurgy announces that its general meetings will be held at the rooms of the Geological Society, Burlington House, Piccadilly, W.1 on the following Thursdays at 5 p.m. (except in May when the Annual General Meeting usually begins at 4 p.m.) 1961—Oct. 19, Nov. 16, Dec. 21, 1962—Jan. 18, Feb. 15, March 15, April 26, May 17.

Obituary

We regret to record the death of Mr. Arthur Sunderland. He had been in the employment of Frank Wigglesworth & Co. Ltd. for 32 years and had been a director since 1953.

A memorial service will take place on Wednesday, October 11, at 11.30 a.m. at St. Helen's Church, Great St. Helen's Bishopsgate, London, for Mr. Guy Falla, O.B.E., the late chairman of Fergusson, Wild & Co. Ltd.

BOARD CHANGES

The Consolidated Zinc Corporation announces that Mr. M. A. Mawby has been appointed chairman of the board of Consolidated Zinc Proprietary, which is the overall management company for the Australian interests of The Consolidated Zinc Corporation.

North Broken Hill Ltd. announces that, at the invitation of the Board, Mr. J. M. Baillieu and Mr. J. B. Harper have accepted a seat on the Board of the Company.

Kennecott Copper Corp. announce the appointment of Charles D. Michaelson as vice-president, mining, and Gordon B. Russell as treasurer and comptroller.

Arising from the transfer of the residence and seat of control of Eastern Smelting Co. Ltd. from the United Kingdom to the Federation of Malaya on September 29, 1961, Mr. D. R. Mitchell, Tengku Mohamed Hamzah, D.K.,

S.P.M.K., P.Y.G.P., Mr. Woo Ka Lim, J.M.N., J.P., and Mr. F. J. Steggall were appointed additional Directors of the Company and Mr. J. C. Budd, Mr. William Mure, C.B.E., and Mr. W. H. Monier-Williams resigned their seats on the Board from that date.

Mr. D. Parry Davies has been appointed a director of Mond Nickel (Retirement System) Trustees Ltd. and is succeeded as comptroller of the International Nickel Co. (Mond.) Ltd. and Henry Wiggin and Co. Ltd. by Mr. L. C. H. Voss. Mr. C. W. R. Edwards has been appointed secretary of the International Nickel Co. (Mond.) Ltd. and Henry Wiggin and Co. Ltd. in succession to Mr. Vaughan, who remains a director of both companies.

Mr. J. W. Price has tendered his resignation as a director and Mr. G. F. Huband has been co-opted to the board of Naragata Karama Areas Ltd.

PERSONAL

Mr. Harold George Hague, coal consultant to the General Electric Co. Ltd., retired on August 31, 1961. He had been at the company's Fraser and Chalmers Engineering Works, Erith, for over 38 years.

Mr. H. Smith, chairman and joint managing director of British Ropes Ltd., has joined the board of the United Steel Companies Ltd.

Mr. J. Brass, at present production director of the Northern Division, N.C.B., has been appointed chairman of the West Midlands Division.

Henry Sykes of London have appointed Scottish Land Development Corporation as agents for their pumps and other equipment, in Scotland and the Four Northern Counties. There will be three main service centres—Glasgow, Fife and Newcastle, and Mr. A. K. G. Gilbertson, A.M.I.C.E., who is located at the Fife depot, is responsible for the over-all operation of the agency. S.L.D.C. will have available from stock for sale or hire, the new 2 in. and larger close coupled Univac pumps and accessories, and this range will gradually be extended.

Mr. Austin W. Scott has been appointed to the board of Armstrong Whitworth (Metal Industries) Ltd., of Gateshead. Mr. Scott joined the company in 1949 and will retain the position he has held for the past two years as works manager of the Jarrow Foundry Division.

Mr. Börje Nilsson has been appointed export manager of Flygt International AB, of Stockholm, manufacturers of fully-submersible electric contractors' and sewage pumps. He will shortly visit Britain as part of a tour of Flygt's overseas agents and subsidiaries.

Robert Hudson Ltd. have appointed Mr. Michael J. Theakston, formerly London manager, as export sales manager based at Head Office, Leeds. He succeeds Mr. R. A. Hudson, who has taken up specialist duties in the company's manufacturing division. The new London manager is Mr. Bernard A. Vickery, formerly sales representative in that area. Mr. Francis Theakston will continue as consultant director at the London office.

Senor Victor Ricardo has been appointed Minister for Mines and Oil in Colombia's new Cabinet.

Mr. J. D. Eccles has been appointed director and general manager of Head Wrightson Stockton Ltd.

Mr. A. J. Long has joined the Head Wrightson Export Co. as general manager.

Having reached the age of 70, Mr. P. W. Howard, deputy chairman and former managing director of BTR Industries Ltd., has retired.

Mr. Sidney H. Ireland has been appointed managing director of Consolidated Pneumatic Tool Co. Ltd. in succession to Mr. Norman Readman, who becomes chairman of the board. Mr. Ireland, who was for some years general manager of the Birmingham Small Arms Co. Ltd., joined Consolidated Pneumatic at the beginning of 1960 as assistant managing director.

Mr. M. W. Seager has been appointed by Richard Sutcliffe Ltd. chief development engineer in succession to Mr. Leslie Baines who, as recently announced, has joined the board of Sutcliffe Hydraulics Ltd.

STANDARD REPRODUCTIONS OF CHEST X-RAYS

New Pneumoconiosis Classification

Fully satisfactory copies of radiographs of the chest have been produced for the first time on a large scale and will be given world-wide distribution by the International Labour Office. The need for an international classification providing a uniform basis of comparison has long been felt. Four meetings of experts on pneumoconiosis have been convened by the ILO to grapple with this problem. The first was held at Johannesburg, South Africa, in 1930; the second, at Geneva in 1938; the third, at Sydney, Australia, in 1950, and the fourth, at Geneva in 1958. The 1958 meeting was attended by 12 experts from 10 countries. These experts succeeded in establishing a single international classification for the radiological appearances of all the pneumoconioses caused by mineral dusts. The object of the classification is to codify the radiological appearances of the pneumoconioses in a simple, easily reproduced way and thus to facilitate the statistical and epidemiological investigations undertaken as part of the search for effective measures to control the disease on a international basis.

The experts agreed in 1958 that their verbal descriptions were not enough. Standard films illustrating the various radiographic appearances defined in the classification were recognized as necessary. It was decided at the meeting that the job of selecting master copies for the definitive set of standard radiographs should be given to a small group of experts working in close collaboration with the ILO. The group consisted of Dr. A. I. G. McLaughlin, Deputy Director, Department for Research in Industrial Medicine, British Medical Research Council, London Hospital; Dr. V. Van Mechelen, Medical Director, Institut d'hygiène des mines, Hasselt, Belgium, and Prof. A. L. Cochrane of the Pneumoconiosis Research Unit of the British Medical Research Council.

The thorniest technical problem involved was that of reproducing radiographs without any increase in contrast and consequent loss of detail. Techniques developed during World War II for the reproduction of aerial photographs helped provide the answer. The use of an electronic scanner combined with the careful control of development times and a good deal of trial and error produced in the end a series of copies described by the experts as the best of their kind anywhere in the world.

Sets of 14 standard reproductions are now being sent by ILO to interested parties throughout the world. A description of classification in English and French is enclosed with each set. The present operation is the first involving an international distribution of reproductions of radiographs.

Sets of standard films may be ordered from the International Labour Office, Geneva, at a cost of \$25 (or its equivalent in local currency) each.

As from October 2, Aluminium (Canada) Ltd., the London correspondent of the Aluminium Limited group of companies, will be located at Berkeley Square House, London, W.1. Telephone: Mayfair 9721.

CLUTHA RIVER GOLD DREDGING

The twenty-seventh annual general meeting of Clutha River Gold Dredging, Ltd., was held on September 27, 1961 at 73, Cheapside, London, E.C.2.

Mr. F. G. Payne, M.I.Mech.E., Chairman, presided, and the following is an extract from his Statement circulated with the Report and Accounts for the year ended March 31, 1961:—

I am pleased to say the Company has had a successful year, in spite of the facts that costs have been heavy, and there has been no increase in the price of gold.

The profit before taxation amounts to £19,790. The net profit after charging £6,739 for taxation is £13,051. The sum of £2,500 has been written off Mining Land, Licences, and Prospecting Expenditure. An interim dividend of one half-penny per share was paid on May 10, 1961, and this amounted to £2,552. A final dividend of 1½d. per share is recommended, which will absorb £7,657, leaving a balance of £3,529 to be carried forward to the current year. If sanctioned, the dividend will be paid on September 29.

The average price received for our gold during the year was £12 8s. 7d. per fine ounce, compared with £12 8s. 10d. in the previous year.

The expenditure in New Zealand was greater than normal, and amounted to £70,577, compared with £61,265 in the previous year. The increase of £9,312 was attributable mainly to heavy expenditure on repairs to stacker equipment and the replacement of the bottom tumbler. Power costs increased by £1,242 owing to the higher charges which came into force on April 1, 1960, and also because some pumping from the Clutha River was necessary to augment the water supply to the dredge paddock.

Turning to the Balance Sheet, you will observe there is a substantial reduction of £15,551 in the value of Stores in hand and Goods in Transit. I consider it important to keep our stock of spare parts as small as is consistent with essential requirements, as the majority of these spares are of little value except for service on the dredge.

Throughout the year the dredge operated in Block 5, and the output of gold has been the best in the history of the Company, except for the year ended March 31, 1938, when 8,241 ounces of gold were recovered from the Clutha River. The recognized Award Holidays in New Zealand involved a loss of 152 hours dredging time. Stoppages during the whole year for general repairs, including the complete overhaul of the Stackers and a short interruption of the power supply, accounted for 458 hours lost time compared with 850 hours in the previous year.

Apart from a short stoppage at the beginning of April for general repairs, the dredge has worked steadily during the current year, and up to August 25, it had recovered 2,866 ounces and worked 2,439 hours, compared with 2,599 ounces and 2,131 hours in the corresponding period of last year.

Finally in regard to the future, the areas held by the Company under dredging licence would normally take about five years from now to work out, but, with the present fixed price of gold and the ever rising costs of wages and materials, it is not likely that it will be profitable to work the greater part of

Blocks 3 and 4. Unless there is an increase in the price of gold, it is proposed to work out only the southern sections of these Blocks and the remainder of Block 5, which ground is expected to give a life of a little under two years. Although there is not much likelihood of securing further payable ground adjacent to our claims, your Board is actively pursuing enquiries in this direction. The problem of the ultimate disposal of the dredge is a very difficult one, and this matter is under enquiry to see if there would be any opportunity of the dredge being sold for a purpose other than for gold winning.

£34,000 and it is anticipated that the work on the dredge itself will be carried out early in 1962, the new bucket band to be fitted at the same time; the dredge will have to be shut down for a month or two for the work to be carried out.

The report was adopted.

KENTAN GOLD AREAS LIMITED

MR. E. F. O. GASCOIGNE'S REVIEW

The Annual General Meeting of Kentan Gold Areas Limited was held on September 28, 1961, at The Chartered Insurance Institute, E.C.2. **Mr. E. F. O. Gascoigne** (Chairman) presiding.

Mr. Gascoigne emphasized that the group's principal asset was its holding in Tanganyika Concessions Limited, and through that Company in the Union Minière du Haut-Katanga. Until a satisfactory political settlement for the Congo and Katanga had been worked out, anxiety must continue to be felt, while there could be little expectation of improvement in the market value of the group's investments pending the return of confidence in investment in this part of the world.

The consolidated accounts at March 31, 1961 showed a profit for the year of £129,659 and after bringing forward the previous year's balance, and allowing for adjustment of taxation of the previous year, a balance of £748,691 remained available for distribution. An interim dividend of 1s. 6d. per share (7½%) had been paid on March 14, 1961, and it was proposed to recommend a final dividend of 1s. 6d. per share (7½%), making a total dividend for the year of 3s. (15%), as compared with 3s. 6d. (17½%) for the previous year.

Detailed information was given in the printed review regarding the Company's principal interests, including Tanganyika Concessions Limited, Tanganyika Holdings Limited, in which a participation of 50% was held, and the subsidiary company, Geita Gold Mining Company Limited.

FOR SALE

Two 25 ton G.E. Diesel Electric Locos 42 in. gauge (can be changed) built 1955. Excellent Condition.

One Model 40 Canton Track Cleaner 42 in. gauge.

Two Coppus TM-8 Fans with 250 V-d.c. 3,500 r.p.m. motors.

Pierce Management Corporation Penna. Power & Light Building, Scranton, Pennsylvania.

Maintenance Engineer required to be responsible for maintaining quarrying and processing plant. Good qualifications and mechanical and electrical experience essential. Previous experience in quarrying, civil engineering or similar industry an advantage. Permanent staff appointment, superannuable with prospects for capable energetic man. Please state fully, age, qualifications, experience. Box No. 703, *The Mining Journal*, 15 Wilson Street, Moorgate, London, E.C.2.

